APRIL 1972

AUSTRALIA'S LARGEST-SELLING ELECTRONICS & HI-FI MAGAZINE

# ELECTRONICS Australia

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## COLOUR TELEVISION AND YOU

## ROBOTS ARE TAKING OVER

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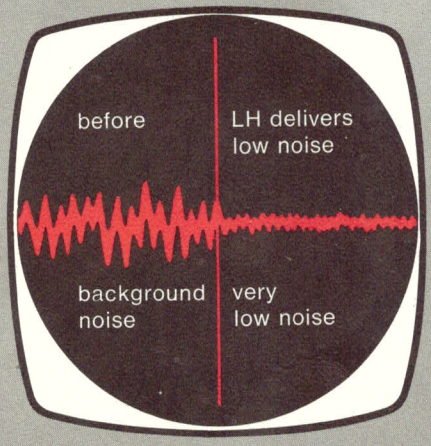


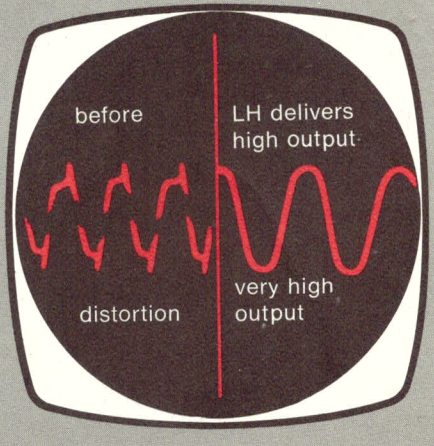


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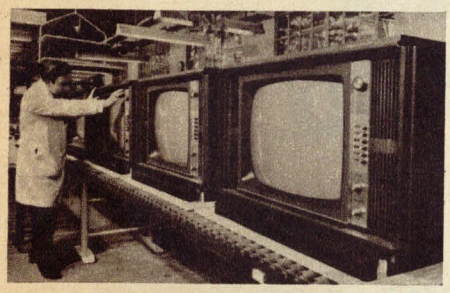
# ELECTRONICS Australia

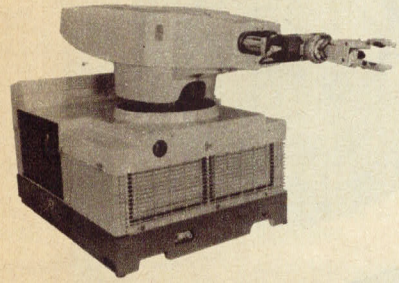
Incorporating "RADIO, TELEVISION and HOBBIES" and "MODERN WORLD"

AUSTRALIA'S LARGEST-SELLING ELECTRONICS & HI-FI MAGAZINE

VOLUME 34, NO 1



COLOUR TV is coming in three years. The answers to many frequently asked questions about this fascinating development appear in the article on colour television on page 6.



ROBOT WORKER. Robots are no longer laboratory toys. Industrial robots are now working alongside humans on factory production lines. The Unimate story starts on page 12.

EXPERIMENT WITH AN IC. Have you been hesitant about building circuits using ICs? Why not take advantage of our special low-cost offer and build some of the circuits in this month's "Elementary Electronics" section. (Page 78.)

## On the cover

There's a double twist to this montage produced by our printers. The Polish export receiver would certainly not have reproduced a colour image. But the colour shot is from the current ATN-7 series "Catwalk", which is being watched by Australian viewers in monochrome! The actress is June Salter.

## CONTENTS — APRIL, 1972

### world of electronics and hi-fi



### projects and technical



### regular features

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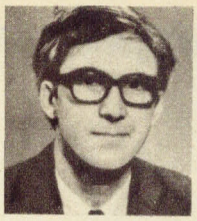

# EDITORIAL VIEWPOINT

## *Colour TV and the tariff question*

Although the main reaction to the recent announcement of the starting date for Australian colour TV transmissions has been one of enthusiasm and approval, this has not been without qualification. Concern has been expressed by many regarding the matter of providing the Australian electronics industry with economic protection by means of tariffs and similar measures. This concern has been expressed not only by representatives of local manufacturers of components and receivers, but also by spokesmen for employee organisations.

There are probably few Australians who would not agree that our local electronics industry should be afforded a reasonable measure of protection, and given the assurance of a fair slice of the colour TV "cake". Yet at the same time many apparently do not realise that to provide this protection is by no means simple and straightforward.

If protection is to be given, it must be carefully planned and regulated. Too much protection tends to place an undue burden on the Australian consumer, by forcing him to pay artificially high prices. It also runs the risk of weakening the incentive for local manufacturers to update their facilities and increase productivity, by effectively removing overseas competition.

On the other hand too little protection may well result in the rapid disappearance of local industry. And while in the short term consumers may be able to buy their colour TV receivers at an attractively low price, in the long term they may find themselves intolerably exposed to the whims of overseas industry.

In fact it is not at all easy to determine just how much protection should be provided. Apart from the complex economic forces acting in the electronics and consumer product industries themselves, there are broader economic and political issues facing the country as a whole. To what degree can Australia afford to close its doors to electronic components or complete equipment from countries whom we rely upon to buy much of our primary and secondary produce?

The situation is complicated still further because the manufacture of PAL-system colour TV receivers will almost certainly involve the Australian electronics industry in some rather curly problems concerning patents and licensing. Already, only a few weeks after the announcement, there is evidence of company manoeuvres based on "patent politics".

All that one can conclude from all this at present, I think, is that the whole question of protection is much more complex than some would have us believe. Yet an answer will need to be found almost immediately if our manufacturers are to be able to make realistic plans for meeting the March 1975 deadline.

*—Jamieson Rowe*




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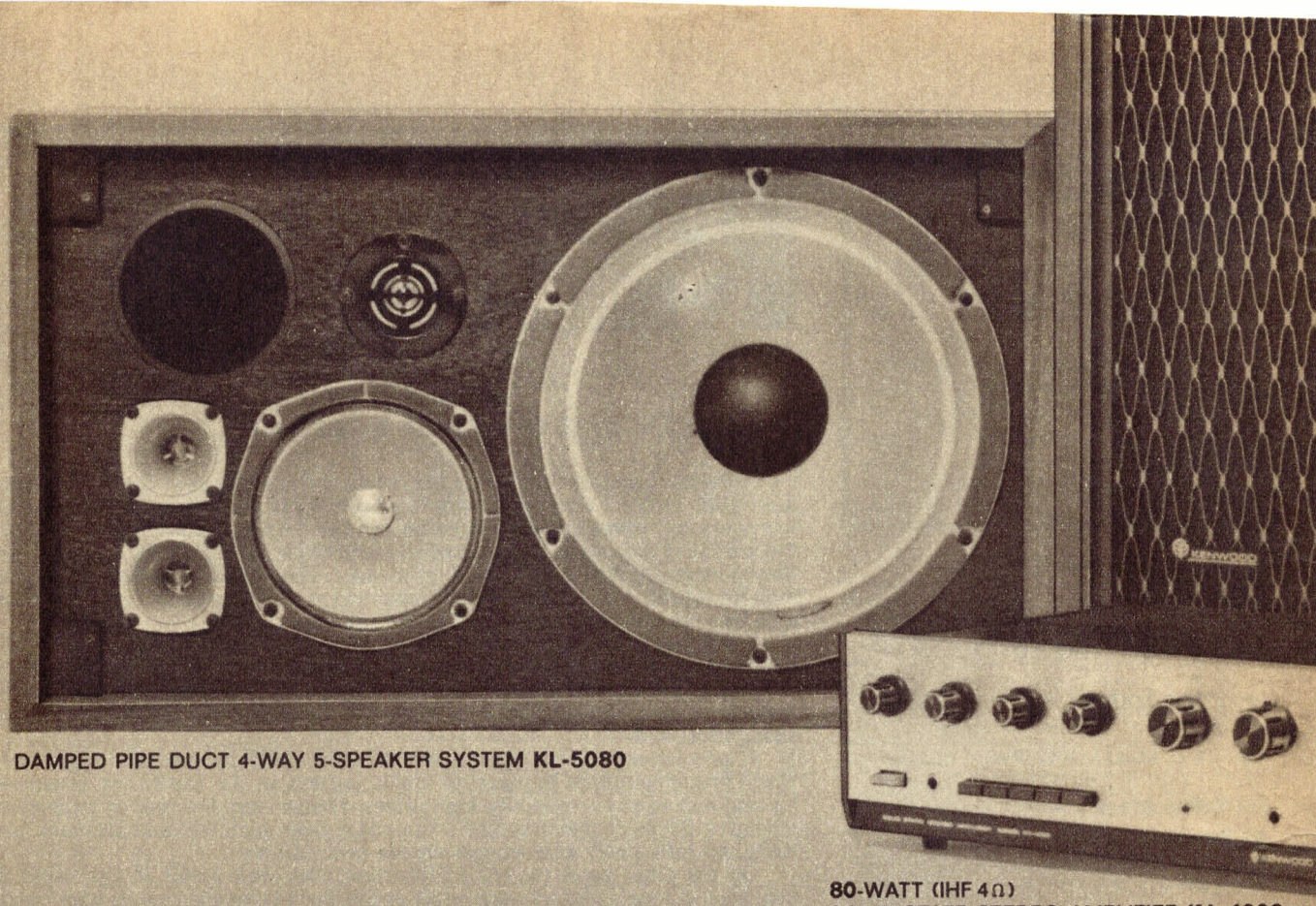

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|---|---|
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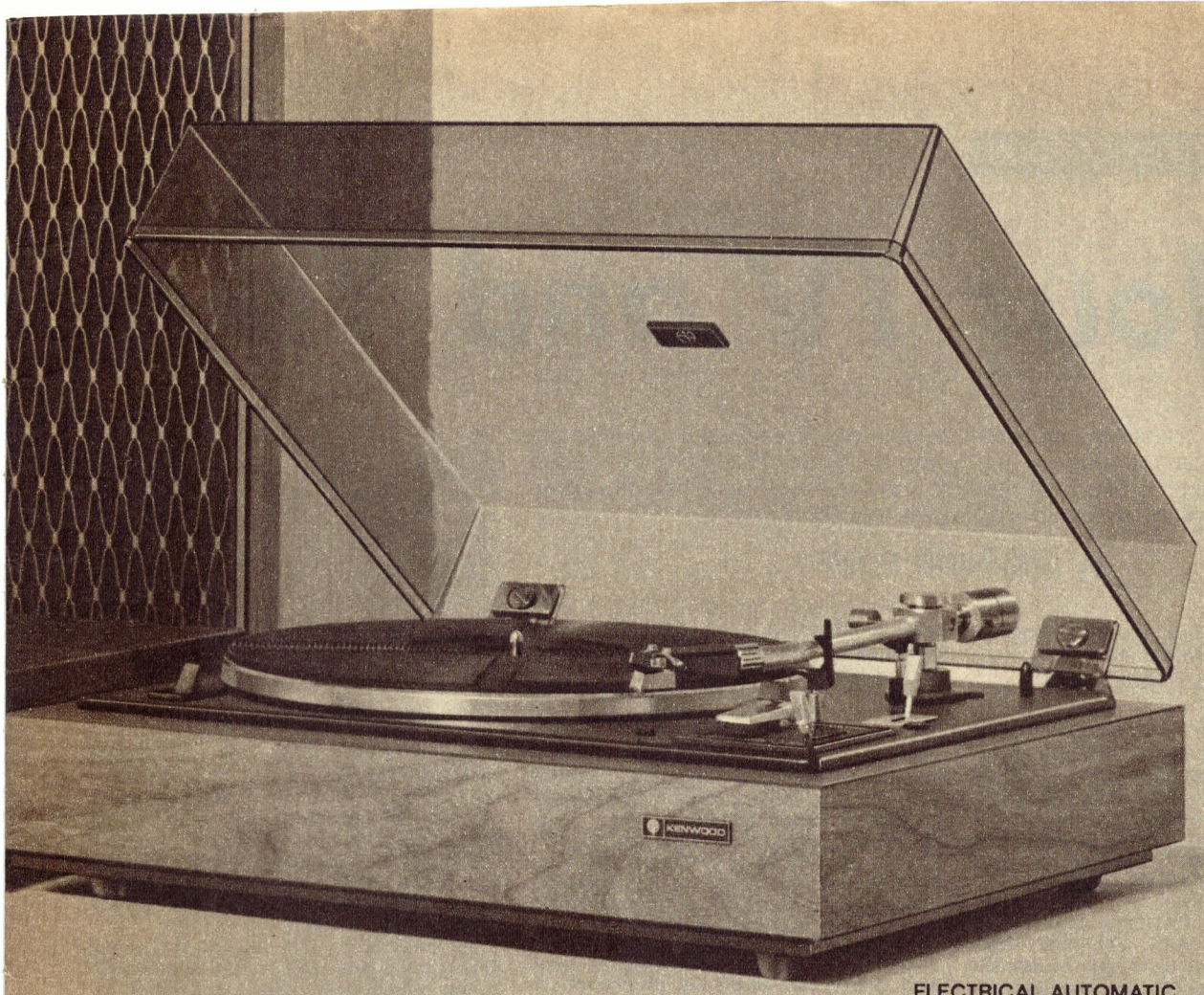


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# Colour TV and You

Although colour transmissions won't commence in Australia until March, 1975, the recent announcement of the date for "C-day" has no doubt raised a few questions in the minds of readers and their families. The answers to the questions most often asked are given in this short article.

by JAMIESON ROWE

***Will my present black and white set still be usable when colour starts?***

Yes, certainly. Like all colour TV systems in current use, the PAL system which we will be using has been designed to be "compatible". This means ideally that not only should monochrome or black and white receivers function normally on colour broadcasts, to produce just as good a monochrome picture as on a monochrome broadcast, but also that colour receivers should be capable of receiving monochrome broadcasts faithfully.

In practice the PAL system achieves these aims very well. The only slight qualification is that on colour broadcasts both colour and monochrome receivers tend to display a faint interference pattern over the screen. But the pattern is normally invisible at the correct viewing distance.

As a matter of fact, you may already have watched colour programs without realising it. Program material imported as colour videotapes is usually transmitted with the colour information still present, although it is not possible to lock the colours properly on a normal colour set (more about this later). If you look closely at the screen of your monochrome set while one of these programs is being broadcast, you should be able to see the faint patterning.

***I have heard that the servicing and adjustment of colour sets are so much more complicated than for black and white that servicing costs are much higher. Is that so?***

Only to a degree. There are more components in a colour TV receiver than in a monochrome set, and therefore in theory at least such a set should require servicing more often. Also the type of colour picture tube used in the majority of present colour sets requires quite elaborate associated circuitry, and a fairly complex setting-up and adjustment procedure. But both these factors should be much less significant by the time colour transmissions begin in Australia in March, 1975.

For one thing, it is likely that the colour receivers developed in Australia will use "solid state" circuitry almost exclusively, and will have very few if any of the thermionic valves which are responsible for many of the service calls to present sets. This should also be the position for future monochrome sets, of course. And as far as the colour picture tube is concerned, it is quite possible that many of the colour sets developed in Australia will not have the type of tube used to date.

Already many of the colour sets produced in Japan incorporate a new type of tube developed by the Sony Corporation, called the "Trinitron". This tube requires significantly less complicated circuitry than the conventional colour tube, and is very much easier to adjust. Many of the colour sets developed in Australia may use either the Trinitron, or perhaps some future development again. So there is no need for undue concern about the servicing of colour receivers, or the cost involved.

***Is there any way that my existing black and white set could be converted to show the colour pictures?***

No, not really. The cost of a custom conversion job on a monochrome receiver would be far greater than the cost of a new colour set. You would have to pay for the many, many hours of a technician's time needed to convert the circuit and wiring of the set, together with the cost of the colour picture tube and its associated hardware. And the results would probably still not be as good as from a new colour set.

A few articles have appeared in overseas magazines describing the conversion of a monochrome set for colour viewing, it is true. But such conversions have almost invariably involved cumbersome mechanical setups involving motors and either revolving colour filter wheels or endless filter belts. A lot of effort is involved, and the results are generally only mediocre compared with a properly designed colour receiver. Picture brightness is very poor, the colours poorly saturated, the detail in the picture is degraded, and generally there is a pronounced and rather irritating flicker.

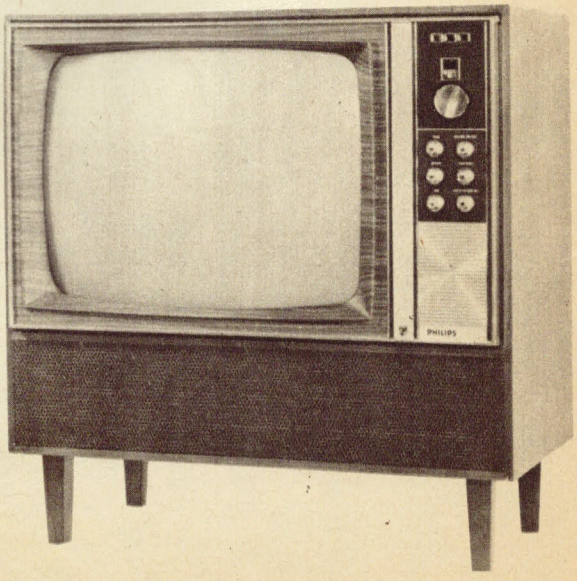
***Will I need a new aerial for colour TV?***

Not necessarily. If you live in a good reception area, and / or you already have a good aerial, the chances are that you will be able to receive good colour pictures without further ado. But if you are already troubled with ghosts and picture instability due to a poor aerial or difficult reception area, then a new and more elaborate aerial will almost certainly be necessary.

The reason for this is that the signal delays, reflections and mutual interference effects which cause ghosts and other annoying effects on a monochrome picture tend to have a far more drastic effect on the colour picture, to the extent of making it quite unwatchable.

Needless to say, those people living in areas where it is at present very difficult or impossible to receive a ghost-free monochrome picture, even with a very elaborate aerial, will find it even more difficult when colour arrives. That is, assuming they would like to watch in colour!

It is fairly safe to say that small indoor aerials of the type which stand on the top of



*Already some Australian manufacturers have produced colour TV receivers, mainly for use as monitors in broadcasting and educational applications. The Philips Model KV692 receiver shown here uses a 25-inch shadowmask colour tube and is designed as a monitor as well as a PAL receiver. (Courtesy Philips Industries Ltd.)*

the set will be quite unsatisfactory for colour, except in very rare cases.

***I have read that colour TV sets cannot be moved around the room without the need for a complete re-adjustment by the service technician. Is that so?***

With very early colour TV sets, the colour picture tube and its associated components were very sensitive to external magnetic fields. Even the very weak magnetic field of the earth itself could influence the operation of the tube, so that moving the set to a different room or even moving it around to a new position in the same room could upset the accuracy of its colour reproduction.

This problem is almost completely non-existent with modern colour TV receivers, however, as designers have both improved the colour tubes themselves, and also provided the sets with circuitry to counteract the effect of external fields. Almost all modern sets are provided with a so-called "automatic degausser", for example, which demagnetises the metalwork associated with the picture tube each time the set is turned on.

It is likely that the receivers available by the time colour broadcasts commence in Australia will be even more stable in their behaviour than at present.

***I have read that you must watch colour TV with the room darkened. Why is this necessary?***

Actually it is less necessary nowadays than it was with early colour receivers, and it is likely to be even less necessary again in 1975. With early colour picture tubes, the light emitted by the phosphors of the tube screen was relatively weak compared with a monochrome tube, so that for best viewing it was necessary to have the room somewhat less bright. But developments in tube design and new phosphors have made it possible to produce a far brighter picture in current sets, largely overcoming the problem.

By the time the first Australian colour sets appear, the pictures obtainable will probably be just as bright as with monochrome, and equally suitable for viewing outdoors or in other situations with a relatively high ambient light level.

***In a recent newspaper story I read that people were watching some of our existing TV programs in colour, and that their sets were fitted with a button which had to be pressed every so often to make the colours come right. Will all colour sets have such a button?***

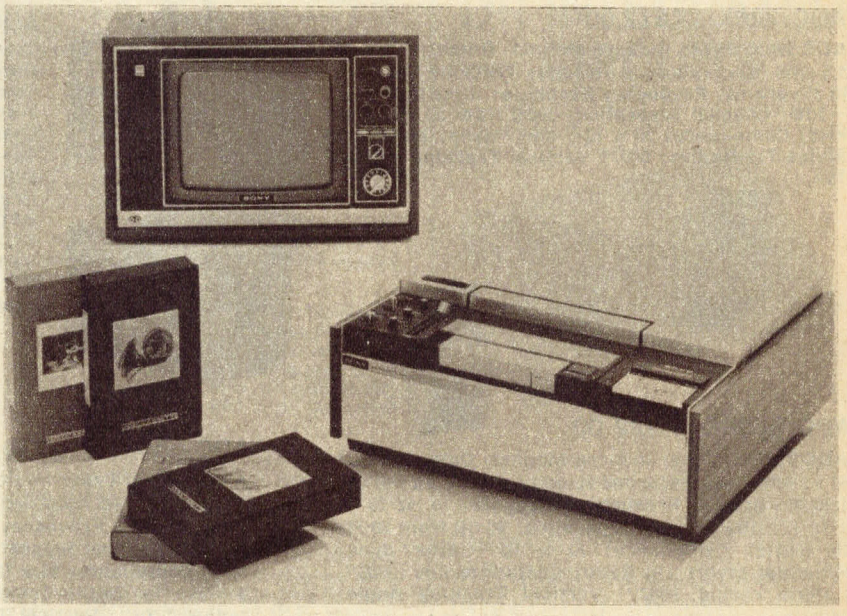
No, definitely not. A normal PAL colour receiver is quite automatic in its rendition of the correct colours for the picture, and needs no manual assistance of this type.

The explanation behind the story you relate is that a certain number of the programs which are currently broadcast from our monochrome stations originate from either imported or locally produced colour videotape. It is difficult to remove the colour picture information from the signals from such videotapes before transmission, so that this information is in most cases transmitted. However, the monochrome equipment in the station tends to remove almost completely the special colour synchronising signal which would be

*(Continued on page 27)*

# SONY COLOUR VIDEOCASSETTES

The Prime Minister's announcement in February of the starting date for Australian colour television transmissions gave additional interest to the recent visit by Mr Taketoshi Kodama, Senior Managing Director of the Sony Corporation of Japan. Mr Kodama was in Australia to demonstrate Sony's newly developed colour videocassette system.



The Sony "U-Matic" colour videocassette system was demonstrated in both Sydney and Melbourne by Mr Kodama and his assistants, in conjunction with Jacoby Kempthorne Pty Ltd, Sony's Australian agents. Jacoby Kempthorne will be setting up special facilities to market the new system, based on their extensive experience with Sony CCTV equipment and VTRs.

As Sony's entry in the world-wide audiovisual player stakes, the "U-Matic" colour videocassette system already has a lead over most of the competing systems: it is in production, not just nearing the completion of development. Although at the moment only available in models for NTSC 525-line 60 field standards, models for PAL/CCIR 625-line 50 field standards should be available by 1973.

Already the Sony system is being used by many educational and training organisations in Japan and North America, and movement into the home entertainment field seems likely following negotiations with film producers, broadcasting networks and other program sources.

The "U-Matic" system is essentially a videotape system, using ¾-inch videotape and a helical-scan format. However the tape is contained in cassettes, rather like a scaled-up version of the widely used "Compact Cassette" developed by Philips for audio use. The "U-Matic" video cassette measures 222mm x 140mm x 31.7mm, and provides up to 60 minutes of continuous colour video recording on chromium dioxide tape.

As with audio cassettes, operation of the videocassettes is made very simple as the tape threading is fully automatic. Cassettes can be removed or re-inserted in the player at any time.

An important feature is that the system is provided with two sound channels, so that program material may have either stereo sound, sound in alternate languages, or a commentary in addition to the original sound track.

Another feature of the Sony system is its high timebase stability, which allows playback of signals into any normal colour or monochrome TV receiver without modification.

Apart from the tape cassettes themselves, the principal component of the "U-Matic" system is the type VP-1000 player pictured. However there is also a full recorder unit, the type VO-1600. Cassettes are available for 10,20, 30 and 60 minute operation, while Sony have available a wide range of equipment for multiple recording of the videocassettes.

Current price of the VP-1000 player in the US is approximately US$1000, with the recorder US$1400 and a 60 minute blank cassette approximately US$35.

In the Sydney and Melbourne demonstrations the system was used in conjunction with late-model Sony colour receivers incorporating the Trinitron tube described elsewhere in this issue. The pictures displayed were of very high quality, and testified to the performance of the Trinitron as well as that of the videocassette system. Even technical viewers were impressed by the colour purity, brightness, clarity and picture stability.

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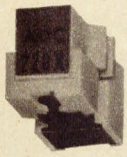


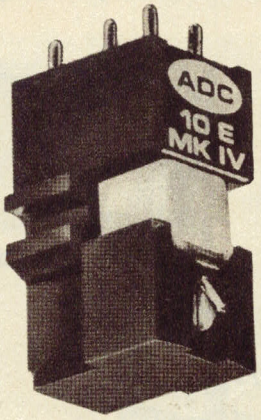


### ADC 10E mk4 . . . $51.00

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**Compliance:** 35 x $10^{-6}$ cms/dyne
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**Vertical Tracking Angle:** 15 degrees
**Recommended Load Impedance:** 47000 ohms nominal

### ADC 220XE . . . $22.00

**ADC 220XE. Type:** Induced Magnet; **Output:** 6 mV at 5.5 cms/sec. recorded velocity; **Tracking Force:** 1 to 2½ grams; **Frequency Response:** 10 Hz to 18 kHz ± 3 dB; **Channel Separation:** 20 dB from 50 Hz to 10kHz; **Compliance:** 20 x $10^{-6}$ cms/dyne; **Elliptical Stylus Tip Radii:** Contact radius .0003". Lateral radius .0007"; **Vertical Tracking Angle:** 15°.

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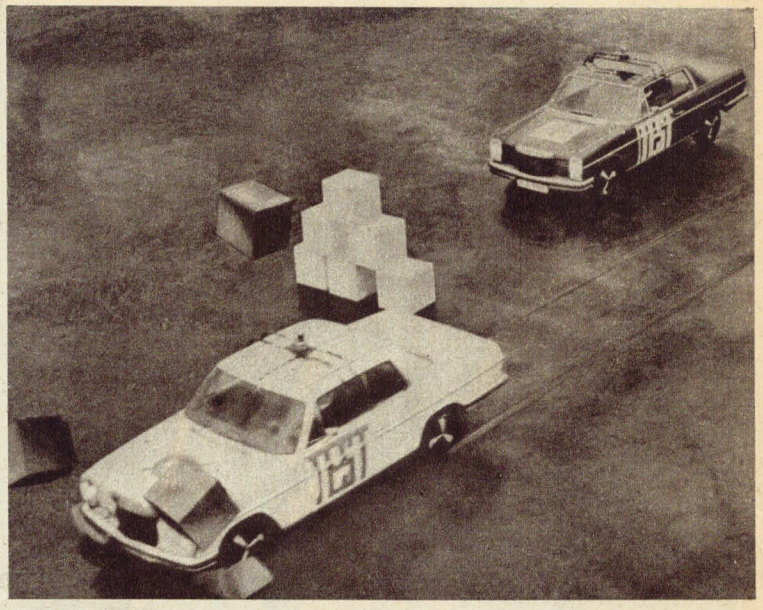
by James H. Dygert



Safer motoring is offered by two systems demonstrated recently in the USA. The first is an automatic anti-collision radar; the second is an anti-skid non-locking braking system.

Rear-end collisions killed 2100 people on US highways last year — not surprising when you consider that a staggering total of 3,800,000 rear-end accidents were reported to the National Safety Council during the same period. But a system developed by a Michigan engineer, coupled with advanced braking systems already appearing on the market, promises to dramatically slash both of these totals in the coming years. The engineer, George Rashid of Warren, Michigan, has perfected what amounts to a self-stopping automobile.

Rashid demonstrates his invention by driving up behind a slow-moving truck. At the instant he ought to start braking, Rashid floors the accelerator instead. As the car leaps forward toward what seems to be an inevitable collision, a warning light and beeper on the dashboard begin flashing and buzzing. At the same moment, the car's brakes slam on and the accelerator under Rashid's foot goes dead. The car stops short of the truck's tailgate. The 55-year-old Rashid turns beaming to his audience, "See," he says, "I can't run into anything even if I want to."

Rashid's system, which has taken 23 years and $4 million to develop, is known as the Rabco Radar Brake. It consists of a miniature radar unit which scans the road up to 1000 feet ahead of the car, depending on the speed, and relays the closing speed of objects in its path to a simple computer. The computer instantly determines whether or not an emergency situation exists. If the closing speed is excessive, the computer first warns the driver with the flashing light and buzzer on the dashboard and then takes appropriate braking action, bringing the situation back under control before a genuine emergency develops. Rashid claims that his radar brake not only eliminates driver error due to fatigue, inattentiveness, intoxication, inexperience or just plain recklessness, but also cuts through fog and rain. It works only at speeds of 5 mph or more — otherwise, you'd never be able to get into a small parking space or even your own garage.

"The system can be installed in any make of car. It's powered by the car's battery, using less current than a transistor radio. Because it was difficult to get potential financial backers to take the invention seriously, it has only recently gone into production. IIC Corp. of Philadelphia, Pennsylvania, manufacturing the systems for Rabco (Rashid Automatic Brake Control) Inc., says the first few units will go on sale in a month or so, priced at $395.

The basic device has five parts — an antenna, and electronics package that is small enough to fit into the average glove compartment, including a transmitter, receiver and computer; a vehicle-speed monitor; a power converter to change the electrical signals into mechanical action; an accelerator actuator to control the accelerator pedal; and the brake actuator. Rashid says it can be installed in half an hour or less.

There's also a temperature-sensing control unit designed to keep the wheels from locking and skidding when the brakes are slammed on automatically. When the heat generated by friction between the tyre surface and the road reaches a certain temperature — indicating the wheel has locked — the sensor activates a vacuum-powered modulator which automatically applies and releases the brakes two or three times a second. On dry pavement the device assures rapid but smooth stops. In rain or snow, it prevents skidding.

In any case, Rashid claims that the driver is never in danger of losing control. If a child darts in front of him, leaving time to swerve but not to stop, the driver just touches the brake pedal, which disengages the automatic brake and allows him to retain full control. According to Rashid, the Radar Brake does not supersede or handicap the driver's skill or limit his choice of action, but serves as "an invisible, never-failing copilot that stays alert, but quietly out of action until danger looms." Then, if necessary, it steps in and does instantly what the driver would do — if he could react fast enough — until the driver can take over again.

The anti-skid component is not new, but is a relatively crude adaptation of nonlocking brake systems developed by the aviation industry and adapted in recent years by auto manufacturers. The latest and most advanced of these is the A-B-S, or Anti-Bloc-System, unveiled last December by Mercedes-Benz and Teldix, an affiliate of Telefunken and Bendix. The A-B-S, extensively tested and demonstrated in Germany and the US, has been introduced as an option on the 1971 Mercedes 280SL, and is being made available by Mercedes-Benz, in the interest of general automotive safety, to any auto-maker that wants it.

In a recent press demonstration, a 280SL fitted with A-B-S stopped from 80mph in 266ft on dry pavement. With the system disconnected, the stopping distance rose to 307 ft. On wet pavement the comparative distances were 326ft and 455ft. The A-B-S Mercedes was then driven with its left-hand wheels on an epoxy strip as slippery as ice and its right wheels running on concrete. When the driver stood on the brake the car stopped quickly and in a straight line, without any corrective steering required. With the A-B-S disconnected, the car went into an uncontrollable spin. In another test, this one at the Indianapolis Motor Speedway, racing driver A.J. Foyt drove an A-B-S car into the first turn—which had been flooded — at more than 100mph. Foyt hit the brake hard. The car stopped in its lane.

Mercedes engineers consider their most significant achievement a single, compact hydraulic unit — containing an electromagnetic valve control mechanism

developed by Teldix — that replaces the vacuum controls of earlier anti-skid systems developed by American automakers. This one unit controls the brake pressure at each wheel individually. A sensor in each wheel hub sends information on the wheel's speed and its acceleration or deceleration to the computer, which activates the hydraulic control unit accordingly. Road conditions and tyre wear are automatically taken into account in the calculations, since they vary with the road friction. For example, a wheel takes longer to speed up again after the brake is released when the road is wet. The system's pumping action — the alternate application and release of brake pressure — must therefore be slower on wet surfaces.

The A-B-S stops in shorter distances on a dry road than the anti-skid systems developed by Ford, Chrysler and GM. Teldix representatives have declined to reveal the maximum pumping rate their electromagnetic valve control permits. Estimates range from 15 cycles per second to as high as 50.

Chrysler's Sure-Brake, a $370 option on 1971 Imperials, has a pumping rate of only 2 to 6 times per second. It works well on wet surfaces, but offers little advantage over the locked wheels of traditional brake systems on dry pavement and needs even more stopping distance than they do on loose gravel.

The Sure-Brake is the only other four-wheel system that has speed sensors at each wheel, but it activates the rear-wheel brakes in unison rather than individually. It gives good steering control, manoeuvrability and stability in most panic-stop situations, but not as good as the A-B-S.

Ford was first with an anti-skid brake, offering Sure-Track, developed with Kelsey-Hayes, as an option on the 1969 Thunderbird and Lincoln Continental Mark II. Only the rear wheels, however, are involved in Sure-Track, which employs an electronic control unit, a vacuum modulator and a single sensor on the rear axle pinion that measures changes in the driveshaft speed. GM followed next, almost on Ford's rear bumper, with a similar system called True-Track, first made available on 1970 Tornados and Eldorados. True-Track has two rear sensors, a computer and a vacuum modulator to regulate brake pressure.

Both Sure-Track and True-Track are based on the theory that a car will tend to skid straight ahead if the front wheels are locked and the rear wheels aren't. Ford promised shorter stopping distances on wet or "slippery" roads, but not on dry pavement. It admitted the new brake took longer to stop a car than normal equipment on low-friction surfaces like wet ice, but said this "small penalty" was "more than offset by the significant improvement in directional stability." This has proven true, however, only in straight-line stops. For good steering control on curves, manoeuvrability around trouble, and stability in all panic-stopping situations, the four-wheel systems by Chrysler and Mercedes are better.

Perhaps the ultimate in safe braking would be achieved if Rashid and Mercedes were to get together and combine the radar's instantaneous reaction with the Anti-Bloc-System's maximum control.

# Traffic Speed Meter Uses Passive Optical System

A new type of road traffic speed measurement system is being developed in the UK by the Marconi Company. The system is completely passive, and does not rely on reflection of signals transmitted by the instrument.

The device is being developed by Marconi Radar Systems and the Great Baddow Research Laboratories within GEC-Marconi Electronics, under contract to the UK Director of Telecommunications, Home Office.

The system is based on an optical method of measurement, originally devised by the company to measure accurately the speed of steel strip as it passes through a rolling mill, when high temperatures prohibit systems involving contact with the strip.

The speed range covered by the new system is very wide, and is mainly dependent on the signal processing. For vehicle speed measurement, the Company is currently expecting to provide an instrument which reads from 20 to 150 miles per hour.

The complete system is contained in a single unit which can be placed at the side of the road, with a view across the road at right angles to the traffic flow. As a vehicle passes the unit, and comes within the field of view of the optical system, its speed will be measured almost instantaneously, and shown on a three-digit display built into the top of the unit.

Provision will be made to 'hold' the readings on the display for a set time to ensure that the operator can make an accurate observation of it.

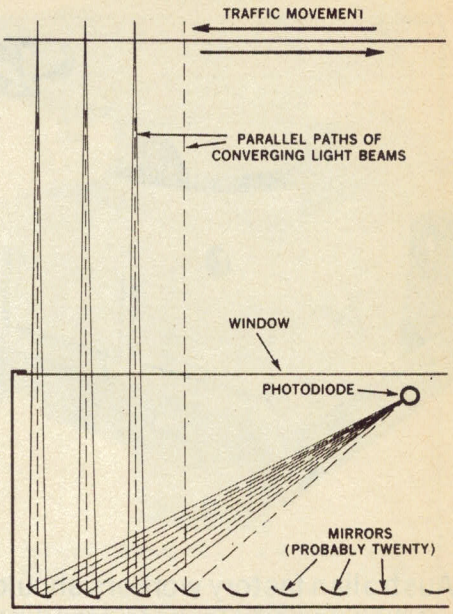
The complete device is small, light and extremely portable. There are no moving parts, and the electronic system is completely solid-state. There are no heavy power supplies or connecting cables.

The device is still in the developmental stage, but the following description will give some idea of the principles involved.

It uses a series of plano-concave mirror strips (probably 20) arranged along the interior back of the unit. The mirrors are mounted with the plane axis vertical and with a gap between each mirror. Each mirror is set at a critical angle to focus onto a photodiode light received at right angles to the face of the unit. The photodiode is located at the front of the unit. (See diagram.)

The parameters of the optical system are so arranged that a point of light at a certain distance in front of the unit will be focused as a sharp image at the photodiode. The exact distance can be varied by varying the position of the photodiode.

*The system is contained in a single unit, placed at the side of the road with a view across the road at right angles to the traffic flow.*




Any sudden change of light level at each of these focal points — as caused, for example, by the presence of a vehicle — will cause a change in light level at the photodiode. Each successive change, as the vehicle moves past each point, will cause an electrical pulse to be generated by the photodiode. Once a series of pulses has been detected in the output from the photodiode, the frequency will be measured by logic circuits, and presented as a direct speed measurement.

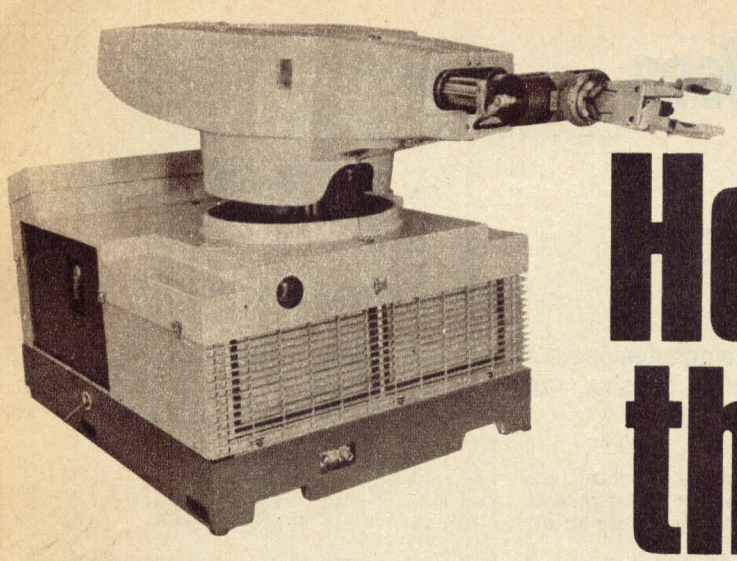
Liquid crystal displays are being considered for this presentation, since they provide a high contrast display at any level of incident light, from direct sunlight to low light levels. At the same time, the power requirements of this type of display are tiny, compared with any other type of display with similar legibility. This is particularly important in a unit which is designed for maximum portability, since battery supplies impose a considerable weight penality.

Because of the focusing effect already described, it is necessary that vehicles to be monitored pass in front of the unit at, or reasonably close to, the focal point. If they are too close, or too far away, the change in light value will not be sharp enough to create a pulse, and will be ignored. This feature would be particularly useful when monitoring multi-lane highways, since the instrument could be set to monitor only one particular lane. (Presumably, additional instruments could be set up to monitor other lanes.)

The equipment is therefore range sensitive, but without the disadvantage that there is any possiblity of inaccuracy in the readings. A vehicle will either register the right speed, or no speed at all.

Similary, any angular misalignment of the meter unit, in any plane, will produce a low reading of speed, depending on the cosine of the angle of misalignment, but cannot produce a high reading error.

The new unit is completely passive in operation, since it does not transmit any form of light or radio energy. In some ways it can be compared with an ordinary camera in that it acts solely as a receiver of available light in any viewing position.



# Move aside mate!

# Here come the robots

**Australian factory workers shouldn't be surprised to find a fellow worker named Unimate standing next to them on the assembly line someday. This unusual employee excels in hot, heavy, repetitive work, thrives on 24 hour days and never asks for a tea break.**

by DICK LEVINE

It has been estimated that there are about 600 robots of all types currently working in American factories and that this figure may grow to 15,000 by 1980.

Unimate is the name of one of the few industrial robots that can be bought "off the shelf" to solve production problems. It is built and sold by Unimation, Inc, of Danbury, Connecticut, in the USA.

General Motors has 26 of the Unimate robots working on a single assembly line.

Unimate takes over jobs which are too harsh or too tedious for men, but too variable for single-purpose automated machinery. A company's prime objective for buying an industrial robot, however, is to save money. It cuts costs, speeds up production and reduces scrap due to human error.

One of Unimate's major advantages is that it can be taught to do a particular job on a production line and when the line is changed or becomes obsolete, the robot can be moved to another site and be quickly retrained to do another job. It can follow a predetermined program of up to 180 sequential operations and automatically recycle itself. It is "taught" to perform these operations right on the job. No pre-programming of its inbuilt computer is required.

For example, it can pick up an object, move it to another location (within a 220°arc), position it within 0.05in accuracy, wait a predetermined interval, then issue signals to other production equipment or respond to other signals with a choice of action patterns

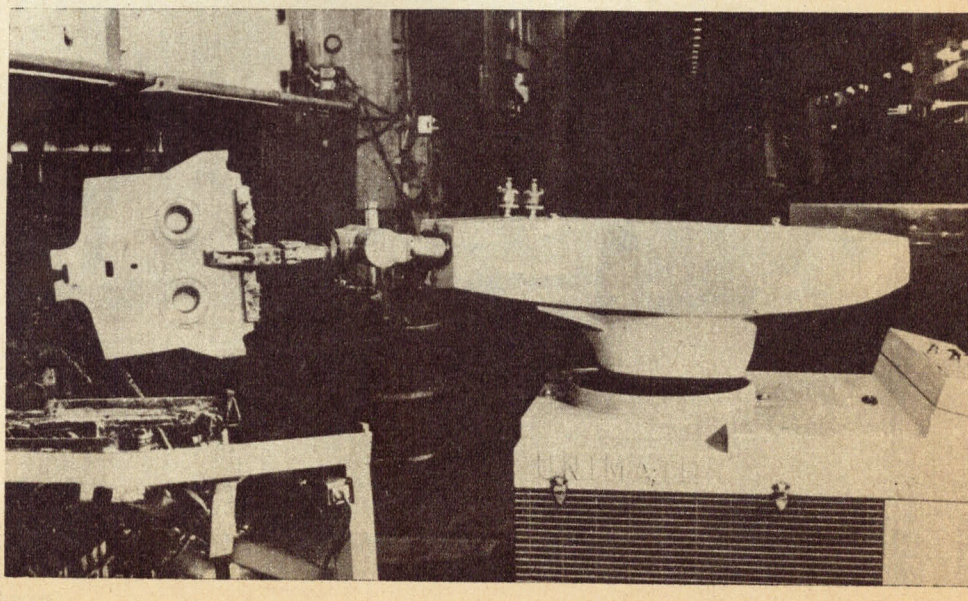
It can handle 25 pounds at top speed and up to 75 pounds at lesser speeds. Its hydraulically controlled arm has a 7½ft reach and its hand can grip a part or tool and rotate it through 180°.

The most common uses so far have been in heavy work, such as removing parts from large metal presses and diecasting machines. The robots are also used on assembly lines for such things as spot welding and stud welding. The Unimates have enough dexterity, however, to handle and package glass tubing, a job they are doing efficiently for one company.

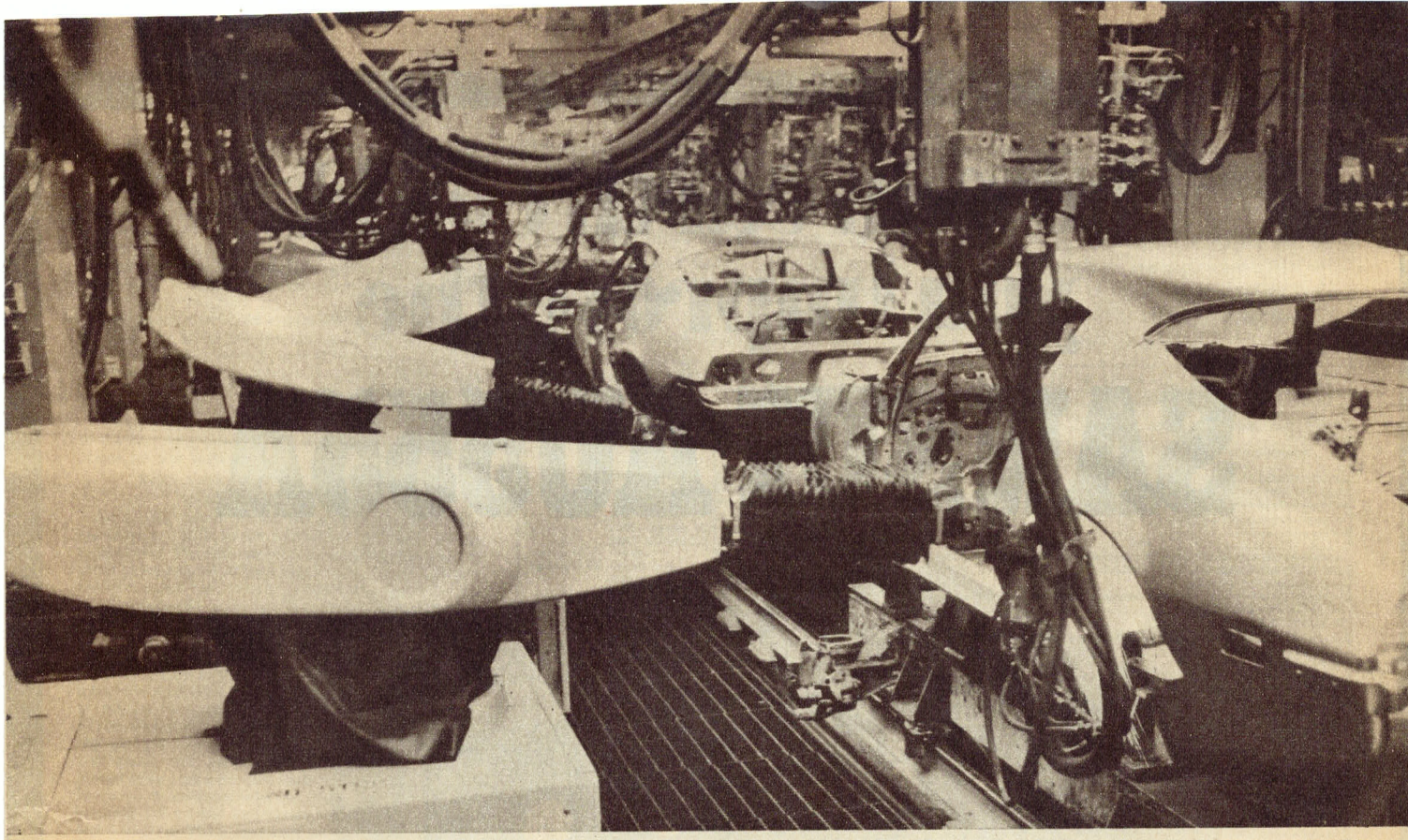
Once Unimate has learned a routine and the program has been proven in practice, a magnetic tape cartridge can be inserted and the routine can be recorded for use at some later date. or it can be transferred to another robot so that two or more Unimates can perform identical jobs.

To train a robot for a job, the arm and hand are manually moved through the desired motions. Feedback encoders automatically send position data to the plated-wire memory in the robot's central control computer, so that it "remembers" the movements. Data for all five of the possible axes of movement are recorded at the same time. Synchronisation signals can also be recorded at any step to enable the robot to work with surrounding machines, or it can be programmed to initiate action signals to other machines.

Unimation Inc originally used a drum memory for the robot's computer, but has switched over to plated-wire memories in current models. Both core and semiconductor memories were tried but were found to be too volatile, that is, they were unable to retain commands in an environment of vibration and unreliable electrical power.



*Robot pulls a heavy springseat from a frame stamping press at Ford Motor Company's Dearborn plant. The Unimate robot can position the part in the die station more accurately than a human.*



*General Motors' production line uses 26 Unimate robots, working in pairs, to weld together bodies for GM's smallest US car, the Vega.*

When General Motors brought out its lowest priced car, the Vega, the company built a completely new assembly plant in Lordstown, Ohio. The new plant was the first automobile assembly plant in the US designed from the ground up to be as completely automated as possible. Over 80 per cent of the body welding is done by robots.

In one assembly line 13 pairs of Unimates face one another at welding stations with spot welders in their hands. They work completely unattended, welding at the rate of 2000 welds per hour per robot.

Human welders tack weld the body and sides of the Vegas together just before the cars reach the Unimate line. With jigs and fixtures removed and the car bodies positioned exactly on the line, the robots take over and complete the welding job. The plant has achieved an unprecedented production rate of 100 cars per hour. The welds are as good or better than welds made by human welders and they are always identical, as the robot is never tired or distracted.

Some Unimates at the Lordstown plant have been modified by GM to tell the difference between one body style and another, because some body styles require more welds or a different pattern of welds than others.

Switches mounted along the assembly line signal information to the robot to help it determine which body style is next in line for welding.

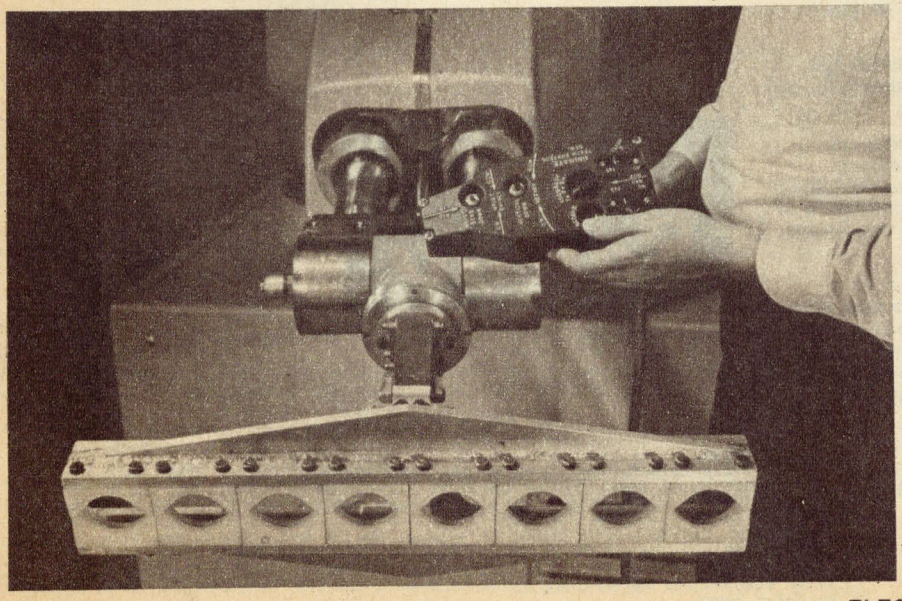
The Unimate can also be employed as a positioning device in the welding process. It can be trained to feed and position the part to be welded, while the actual weld is performed by a spot welding machine. The robot can operate the welding machine and time the weld if necessary.

The major occupation of Unimate robots in the auto industry has been loading and retrieving parts from large presses and diecasters. At the Ford Motor Company's Dearborn Frame Plant the robots are handling 33lb spring seats for the rear suspensions of new Ford automobiles. Two Unimates work together at adjacent frame presses, assisting a two-man crew.

Each of the presses has two die stations. Parts are fed into the first die station on each press manually, then the robot takes over, retrieves the part from the first die, turns it and positions it accurately in the second die station. Movements of the two robots are synchronised with the movements of the press rams by means of limit switches which prevent the robots' arms from entering the die areas until the rams are in their up position.

The use of robots in this application has economic advantages, but the principal motivation was saving workers from exposure to hot and heavy work which is also dangerous. Productivity was increased because the robots, with their long reach, were able to position the parts more accurately than the men, who were using long hooks to do the positioning.

One application where the Unimates save workers from unpleasant conditions is the extraction of diecastings from machines used in short and medium run diecasting. Long run diecasting machines are usually



*Unimate with special "hand" fitted, is led through the correct sequence of events to enable it to perform an assembly line job.*

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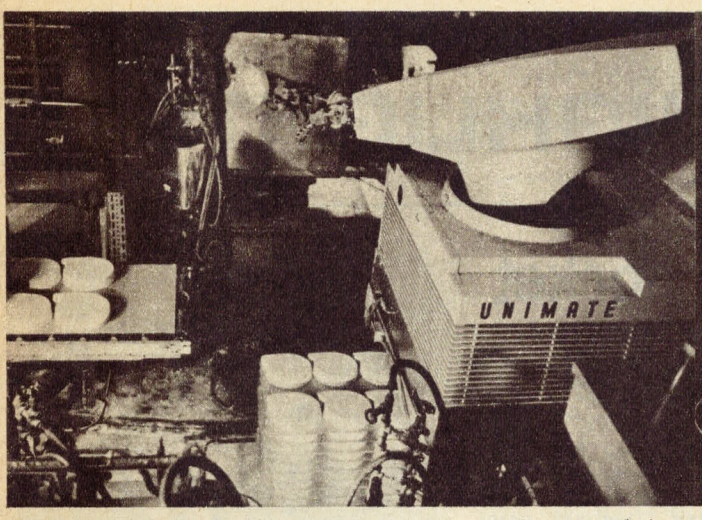
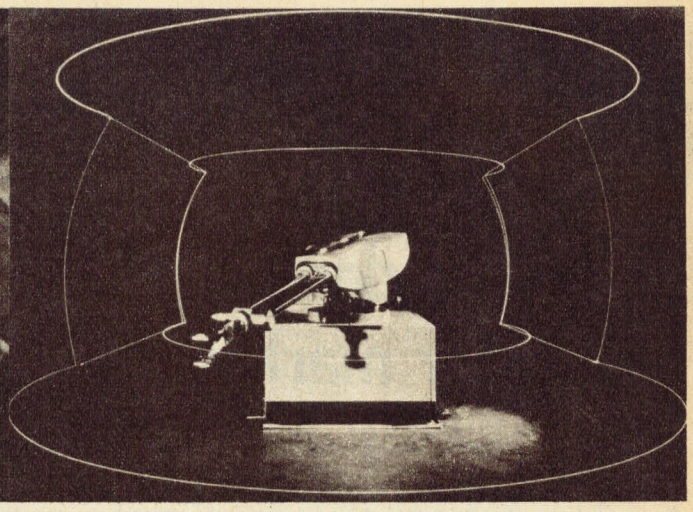



*Robot unloads a part from a plastic injection moulding machine and arranges it for painting. After painting, it stacks parts on a pallet and places separators between each layer.*



*Unimate holds a small light while going through its paces to show the area within which it can manoeuvre. Many different hands and fingers can be ordered.*

automated with mechanical extractors, but with short runs the castings are removed manually. In this case, the robots are equipped with fingers which grasp the hot casting and pull it away from the pins just like a human operator does.

Unimate can retrieve castings from two diecasting machines alternately, inspect each for completeness with an auxiliary infrared sensor, trim the flash, remove casting gates, quench the casting and load it onto a conveyor or into a container. It can also clean and lubricate the dies in the diecasting machine.

In fact, it has been found that with aluminium diecasting, where special die care is extremely important, the robots do a better job of caring for the dies than human operators. This is mainly due to regularity and uniformity of the cleaning and lubricating care given by the robots. Diecasting operators not only vary in their die maintenance because of personality differences, their care also varies as a function of time of day.

Other production areas in which Unimates are being used are in heat treating of metal parts and in hot forging operations. In both cases the robot's fingers pick up red hot metal parts and run through the process without damage to the robot itself.

How do trade union members feel about turning over their jobs to robots? So far there hasn't been much objection from American unionists, as the companies have been careful to use robots for either dull, repetitive jobs or hazardous jobs. Workers replaced by robots have usually been transferred to better jobs which require intelligent decision making. And presumably, a device which improves the productivity of the factory benefits everyone.

What about the future?

Unimation Inc is now developing a model with "eyes"; a television scanning device that will enable the robot to see what it is doing. Undoubtedly robots of the future will not only have eyes, but electronic ears and a greatly improved sense of touch as well.

With labour costs rising and a constant demand for greater productivity, we will probably see more robots in factories. After all, they are not really so different from ordinary automated machinery, they just have a great deal more versatility.

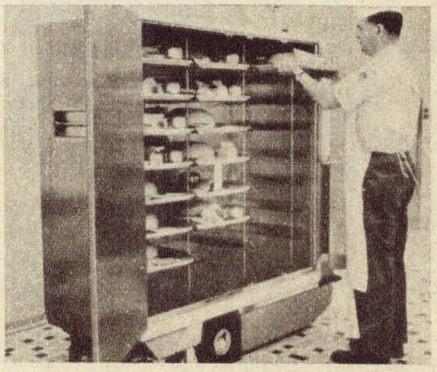
# ROBOTS IN HOSPITALS

**Another robot worker now being used in the USA is AMSCAR, an electronically guided delivery cart which silently rolls around large hospitals delivering meals, linens and other supplies.**

People watching the AMSCAR in action have a right to get a bit nervous. The 500lb battery powered cart, which can carry up to 900lb cargo, glides down hallways guided by a wire buried in the floor. It pulls up to its own private lift, calls the lift, then enters and electronically signals the lift as to which floor the cart is programmed to go next. To the untrained observer it all looks very mysterious.

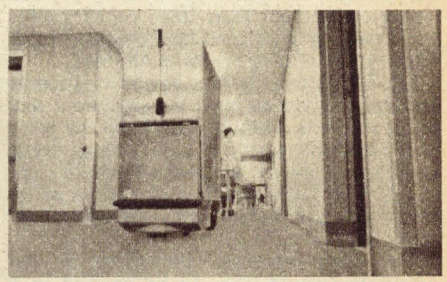
But to hospital administrators the carts mean solid dollars and cents saved in wages for the dozens of porters who formerly would have pushed manual carts around a hospital. Also, the work is menial and often dirty, and US hospitals are having a hard time finding people to work as porters for the money a hospital can afford to pay.

The AMSCAR carts not only deliver food and supplies, they also return the dirty dishes to the kitchen and other soiled



supplies to hospital laundries and sterilising centres. After a return trip with dirty trays, linen, etc, the carts automatically run through a "car wash" using 180° water, are air dried, then return to the kitchen or other loading station to be filled again.

The carts can be sent out or returned simply by setting a control on the cart itself and positioning it over the guide wire. When it reaches its destination it stops in a designated area to wait for unloading or for repositioning by a hospital employee. The AMSCARs can be manually led around by

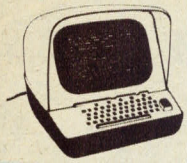


means of a handle at the front of the cart which automatically returns to a vertical position and shuts off drive power the instant it is released.

Sensing devices apply the brakes if the cart should run into anything. A sonic proximity braking system is an optional extra. Even so, nursing sisters are not fond of the robot carts. The carts are nearly six feet high — taller than most sisters — and many sisters do not feel comfortable operating an electrically driven machine of that size.

But it looks as though robot carts are here to stay. One hospital administrator claims the AMSCAR installation has cut personnel costs up to 20%, and in a large hospital 20% of the wage bill is a lot of money.

AMSCARs are made by Amsco Systems Company of Erie, Pennsylvania, a division of the American Sterilizer Company.



# NEWS HIGHLIGHTS

## Japanese domination of pocket calculator market challenged

In the United States, as in Australia, virtually all hand-held calculators sold since their introduction have been made in Japan — even those marketed under the labels of local manufacturers. A new American challenge promises to bust the small calculator market wide open.

Two calculators recently announced in the US are aimed at markets so far untapped, and both will compete strongly in size, price and performance with Japanese designs.

The smaller of the two, called a "micro electronic calculator" by its maker, would fit comfortably in a man's shirt pocket, but is a full four function, eight digit device (16 digit capacity) with a floating decimal point.

The micro calculator's small size is due to the development by its manufacturer, Ragen Precision Industries, North Arlington, NJ, of small C / MOS chips which perform all the arithmetic functions and control the display. The display, also made by Ragen, is a liquid crystal type. The combination of semiconductor chips with the liquid crystal display draws so little current that the unit is powered by dry cell batteries rather than the rechargeable types used in most hand held calculators. A battery life of 2000 hours is claimed.

The Ragen calculator is aimed at students and housewives as well as engineers and office workers. They hope to keep the price under US $100 and will sell through large department stores. A prominent chain store in the New York area has placed an order for 20,000 calculators with an option for 20,000 more.

The other recently announced pocket calculator would have to be carried in a larger pocket, but it goes far beyond the four-function capability of the usual mini calculator. It is the new HP-35, made by Hewlett-Packard, the well known electronic instrument manufacturer.

The HP-35, designed for scientists and engineers, will perform logarithmic, trigonometric, square root, exponential and other mathematical functions as well as the usual mathematical ones. It can give you any of these more complex functions in less than 500 milliseconds at the touch of a single key. It is a fast, accurate replacement for an engineer's slide rule.

It also has a stack of four registers for storing intermediate values during a calculation and a memory register for constants, which can be displayed at the touch of a button. It can be either mains powered or portable with rechargeable nickel-cadmium batteries.

Hewlett-Packard is using MOS / LSI circuits made with the ion-implant process. Light emitting diodes (LEDs) are used in the number display. Decimal point positioning is automatic and values can either be entered in conventional or scientific notation with the exponent of 10 ($10^{-99}$ to $10^{99}$) shown at the right of the display.

It is claimed that the HP-35, weighing in at only 9 ounces and selling for less than $400, is a match for many of the desk top calculators selling for over $1000 and has beaten the Japanese to the market.

The HP-35 will be available in Australia within a few months at a price very close to the price in the US, that is, less than $400.

Much of the renewed interest in mini calculators in the US is due to new MOS technology. Texas Instruments are now producing an MOS chip that contains all the circuits for a small calculator in a package half the size of a paper match book and which sells for under $20 in quantity. Some market observers predict that basic pocket calculators suitable for the home and student market will come down to about US$80 when volume production gets under way.

*MICRO CALCULATOR. Al Medwin, President of Ragen Semiconductors Inc, holds his company's C / MOS chips and liquid crystal display in one hand and the parent company's pocket calculator in the other. Hewlett-Packard's HP-35, designed for the slide rule market, displays up to 10 significant decimal digits and automatically positions the decimal point throughout its 200 decade calculating range.*

## Brazil buys Ikara anti-sub system

The Brazilian Navy is to buy Ikara anti-submarine missile systems worth about $20 million from the Australian Department of Supply. The Ikara system, wholly developed in Australia, is also being manufactured for the Royal Navy. It is considered by many to be the best anti-sub system in the world.

Much of the $20 million will be spent with private industry, as more than 100 Australian subcontractors are associated with the weapon's design, development and production.

Ikara has already been fitted to nine RAN ships. It consists of a solid-fuel rocket which carries a homing torpedo to the target area and releases it at the ideal water entry point. The torpedo drops to the water by parachute. Ikara's advantage over other similar systems is that it can be guided by the launching ship during its short flight to compensate for last-minute manoeuvres of the submarine under attack.

An in-depth story of the development of the Ikara system and how it operates was included in the July, 1969 issue of "Electronics Australia."

## French satellite to track our rock lobster

French space science and Australian marine science will be linked in a joint research project off the coast of Western Australia later this year. The project will be a joint venture between the National Centre for Space Studies (CNES) in Paris and the CSIRO Division of Fisheries and Oceanography, Cronulla. New South Wales.

The Division's research group located at the Western Australian Marine Research Laboratory at Waterman, Western Australia has been carrying out studies on the western rock lobster for some years and in the course of this work has been gathering oceanographic data.

Ocean currents play a central role in the plankton stage of the life cycle of the lobster. The minute larvae of this free-floating stage have been found up to 700 miles from their hatching grounds outside the coastal reefs.

The French "EOLE" satellite to be used for the project was launched on a Scout rocket in the USA by NASA last August and has largely been engaged on a massive meteorological project since that time.

For the Australian project, the satellite will collect information later this year from an instrument-laden buoy as it drifts westwards in the ocean from a launching site near Perth.

The satellite will track and interrogate the buoy on each pass of its 103-minute orbit. On command from the satellite, the buoy will transmit data on air temperature and on sea temperatures at the surface and at a depth of 300 metres. Using ranging and doppler techniques, the satellite will record the position and speed of drift of the buoy.

The information will be transmitted to one of six stations of the CNES tracking and telemetry network distributed around the world.

Re-transmitted to a data processing centre at Bretigny, France, it will be forwarded to Australia in the form of a computer record. CNES will lend the Australian scientists the matched radio instruments necessary for transmitting data from the buoy to the satellite.

The sensors on the buoy will be supplied by CSIRO. The assembly will be placed on board an oceanographic vessel shortly to test the technique before the instrumented buoy is launched off the Western Australian coast late this year.

Satellite-based observations offer a high degree of precision in fixing location regardless of weather conditions. This holds true not only for instruments mounted on a buoy but also for instruments operating on an oceanographic vessel where precise location of the sampling point at which sea-water samples and other data are obtained is essential.

## Police radio network near completion in Papua/New Guinea

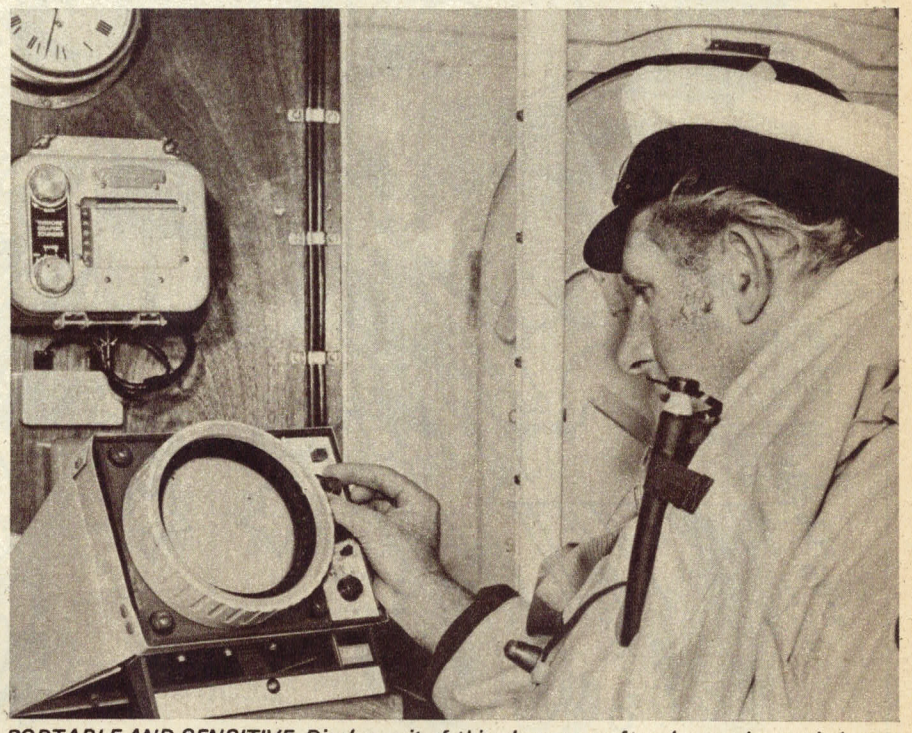
Establishment of a network of high frequency single-sideband radio stations giving direct communication between the larger police stations and certain patrol posts in Papua-New Guinea is almost complete.

The majority of the stations planned for the network are now in operation and give an emergency coverage 24 hours a day.

The network was designed and installed by Amalgamated Wireless (Australasia) Limited and the Territory Administration.

Police headquarters at Konedobu, Port Moresby, are equipped with a number of transceivers working into divisional headquarters at Boroko, Madang, Mount Hagen, Lae, Rabaul and Kieta. These divisional stations, in turn, are in direct communication with network stations in their areas.

The effectiveness of the network was demonstrated dramatically during last year's severe earthquakes in Rabaul. The system enabled police communications to be maintained without interruption throughout the emergency, allowing rescue and relief work to be co-ordinated and expedited.



*PORTABLE AND SENSITIVE. Display unit of this pleasure craft radar can be carried up to the flying bridge. The Decca 050 mini radar, for boats under 12 metres, boasts a large slotted waveguide scanner for accurate bearing discrimination and a solid state local oscillator and mixer giving sensitivity claimed to be equal to that of larger ship radars. Australian agents are the Communications and Navigation Division of Electronic Industries Ltd, 121 Crown St, East Sydney.*

## Fuji unveils colour cine-video

The bright future promised for home video playback systems has apparently enticed yet another manufacturer to enter the fray. The competing videotape, EVR, laser-beam and videodisc systems are now joined by a cine-video or "CVR" system developed by Fuji Photo Film Company in Japan.

The Fuji CVR system has at its heart a simplified colour telecine unit which uses standard super-8mm home movie film. The unit will accept either cartridges holding up to 11 minutes of film, or a reel-to-reel adapter holding 30 minute reels. It uses a rotating prism and flying-spot scanning system, with continuous film motion, and caters for both black and white and colour film. It delivers a modulated RF signal suitable for direction connection to the aerial terminals of a standard TV receiver. The unit is intended for optical sound reproduction from the super-8mm film, using a silicon photodiode.

To complete the system is the Fujica ZS-400 camera, which although similar in size to a standard super-8 camera has full optical sound recording facilities built in. The user is thus able to take lip-sync optical sound colour films, which after processing may be shown on his colour TV set via the telecine unit. The films could alternatively be projected on a standard projector. Sound recording in the camera is via a miniature light-emitting diode (LED).

Advantages claimed of the Fuji system are that it offers full record-play facilities, in colour and with sound, for an outlay far below videotape. Price of the telecine is expected to be about $875, and the camera $240.

# NEWS HIGHLIGHTS

## US science award to CSIRO scientist

Dr A. Walsh, Assistant Chief of the CSIRO Division of Chemical Physics, who developed the atomic absorption spectrophotometer, has been selected to receive the Maurice F. Hasler Award in Spectroscopy, presented annually by the Society for Applied Spectroscopy, USA.

In announcing the award the Minister for Education and Science, Mr Malcolm Fraser, said that as a result of the work of Dr Walsh and his colleagues Australia is the acknowledged world leader in atomic absorption research as well as in its application to the economy.

Australia is a major exporter of the instrument; it is also being manufactured under licence to CSIRO in major industrial countries, Mr Fraser said. About 15,000 atomic absorption instruments are now in use throughout the world.

A highly sophisticated instrument, it is widely used throughout the world in industry, agricultural research and medicine. The instrument has made a major contribution to mineral exploration in Australia by the ease with which it can carry out rapid analyses in the field.

Dr Walsh, a Fellow of the Royal Society, London, a Fellow of the Australian Academy of Science and a Foreign Member of the Royal Academy of Sciences, Stockholm, received the Brittanica Science Award in 1966.

## Research breakthrough on tubeless TV camera

A light-sensitive solid state structure capable of storing a pattern of tiny static charges and moving them in sequence at TV speeds has been developed by the RCA Laboratories, Princeton, NJ. The sensor, which is a silicon integrated circuit with over 1400 photo-elements in a ladder arrangement, could be the key to the development of a commercial tubeless TV camera.

The prototype is capable of taking a recogniseable picture as is, but the number of elements would have to be increased to about 500,000 to reach broadcast picture standards.

Light focussed on its surface through an ordinary camera lens produces in each element a positive electric charge which varies in direct proportion to the light intensity. The electrical equivalent of the image is stored in the sensor material as a pattern of static point charges. The charges can be read out in sequence and fed to a TV receiver by a unique "bucket brigade" action in which the discrete charges are passed along from one element to another.

The bucket brigade action is effected by using a clock pulse to raise the potential of each element in the proper sequence so the charge flows to the next element, which is at a lower potential. A shift register selects the lines to be read out in sequence, one at a time, to form the complete picutre.

Only nine external leads to the device carry all picture information and control signals.

# Don't forget to water your antenna!

Those of you whose neighbours complain of the forest of antennas in your back garden can take heart. The US Army has found a way to use a real forest as a giant antenna.

They have developed a doughnut-shaped coil, which when wrapped around the trunk of a tree, converts the tree into an omnidirectional antenna for both transmission and reception. If the tree's roots and foliage interconnect with nearby trees, the others become parasitic elements and the whole group will operate as a giant antenna.

A government patent has been granted to M. Acker, Dr K. Ikrath and W. A. Schneider, who developed the device at the US Army Electronics Command, Fort Monmouth, NJ. The invention has been field tested in New Jersey and in Panama.

Called Hemac, meaning hybrid electronic antenna coupler, the coil is expected to be useful as an accessory device in the jungle when normal antennas do not work.

Any private broadcasters wanting to try forests as antennas may apply for a license under US patent number 3,646,562.

## Sony colour – made in USA

Sony's wholly owned subsidiary, Sony Corporation of America, plans to start production of colour television sets next month in a new plant in suburban San Diego, California. The initial production target will be 5000 Trinitron sets a month.

The 24,000 square foot factory is designed so it can be easily expanded. Sony Corp eventually plans to assemble up to 20,000 sets a month at the new location.

## New source of electric power—runs on water and alkali metal

A compact power source that can produce levels of electric power greatly exceeding that of conventional batteries has been developed in the laboratories of Lockheed Missiles & Space Co, Palo Alto, California.

The source has been developed in two configurations, described as a "dynamic cell" and a "static power cell". The devices are fuelled with two plentiful materials — water, and an alkali metal such as sodium or lithium.

Lithium and sodium are among the lightest in weight of all metals, and when they come in direct contact with water, they normally react violently. Because of this high reactivity, it was not believed practical in the past to combine them directly with water to obtain electrical power.

However, Lockheed has found a way to control this reaction and to extract large quantities of useable electric power. The static cells, like conventional battery cells, can be made in various sizes and connected in combination to make up batteries with various voltage outputs and current capacities.

The cells produce many times more electrical power per pound than is available from the common lead-acid storage battery — up to 100 times more in long term applications where water is freely available. They will also operate more efficiently at lower ambient temperatures than will the lead-acid battery.

The static cell produces electrical power as its output without moving parts, as in conventional batteries. Several working prototypes have been operated.

The dynamic cell has a rotor, and can convert its electro-chemical activity directly into mechanical output. A laboratory model of the dynamic cell has been built to demonstrate direct conversion of the cell's electrical energy into rotating shaft power — a combined electric motor and power source.

Researchers at Lockheed's Palo Alto Laboratory describe the cell as uniquely simple. As long as the cell is fed with its two fuels — water and metal — it will continue to produce electrical energy. No electrical battery charging is needed, no catalysts are added, no special membranes are used.

A further advantage of the Lockheed power cell is that it can operate without releasing any harmful pollutants. One by-product of operation is pure hydrogen, which can be used as a subsidiary energy source, or oxidized to form water. The other by-product, alkali metal hydroxide, can be stored for later use.

One envisioned future application of the power cell and its by-products is in electric vehicles. The electricity generated by the cell could provide the propulsion; the hydrogen by-product could power accessory devices; and the alkaline hydroxides could be stored for later reduction to basic fuel metal.

A more immediate application of the cell is as a compact marine power source because the cells would be immersed in one of the required fuel elements. Cells containing the alkali metal, and capable of using the available sea water, are being developed.

# NEWS HIGHLIGHTS

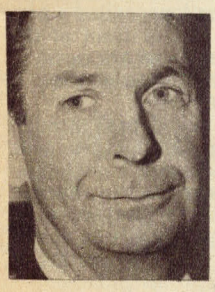
## New colour VTR saves on tape

Two of Euope's leading manufacturers of television broadcasting equipment, Philips and Fernseh, have jointly developed a professional colour video tape recorder which promises to be less expensive to buy and to operate than today's recorders.

The Philips-Fernseh recorder has an omega loop tape path and uses a single video head for both recording and playback. Tape consumption is reduced to about one-third. Two independent sound tracks are provided to provide facilities for future stereo sound programs.

In addition to the control track there is an auxiliary track available for cue and address code purposes. The first version will be available for both PAL and SECAM systems.

First demonstrations of the new colour VTR were presented to representatives of European broadcasting organisations at Munich, German and Hilversum, Holland, in February.



## Sydney scientist is right— Earth's core is solid!

New research on earthquake waves in the United States has confirmed the theory put forward 25 years ago by Professor K. E. Bullen that the earth's core is solid. The study, financed by the US Department of Defence, was established to find better methods of detecting nuclear explosions.

Sensitive new equipment for the detection of S waves was able to detect these particular seismic waves in the earth's inner core. S waves can travel only in solid material.

The earth, the study showed, has a solid inner core 1600 miles in diameter, surrounded by a fluid outer core 1400 miles thick. Scientists had previously thought the earth's core was completely fluid.

Professor Bullen says he formulated the theory by chance when he accidently placed two graphs together, showing the earth's compressibility and density, and noticed a relationship between the two.

Professor Bullen recently retired as head of the Applied Mathematics Department of the University of Sydney. He has won several US science awards for his research on the inner structure of the earth.

## VL2UV courses now on tape

Cassette and 5in reel tapes of courses offered over Radio University VL2UV, Sydney are available for home study from the University of New South Wales. The courses are designed for individuals wishing to study in their spare time or for as part of company in-service training programs.

Some of the current courses are: Managing Small Business, Computers at Work, Economics for Non-economists, Industrial Relations, Statistics, Pert and Critical Path, and Counselling. The fees vary from $21 to $36.

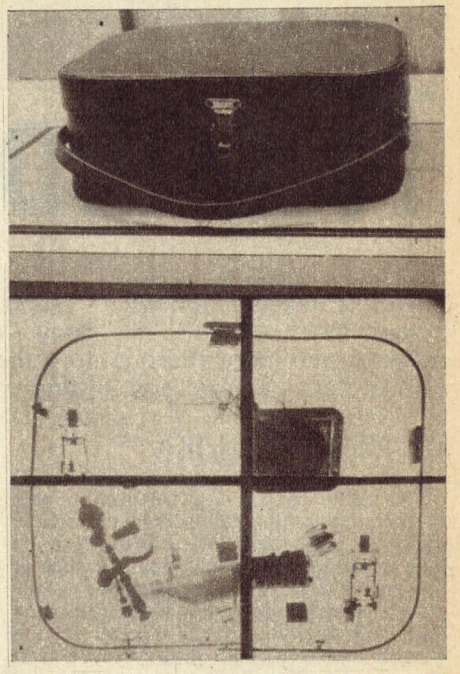
The courses are at a postgraduate level but are aimed at broadening graduates' knowledge in fields outside their specialty. Enquiries should be addressed to: The Division of Postgraduate Extension Studies, PO Box 1, Kensington 2033.

## Swedes install picture phones in public telephone booths

A number of picture telephones are to be installed in public telephone booths in Sweden under the terms of a plan just released by the Swedish National Telecommunications Administration. The new picture phones will enable the public to have voice and picture communication between Stockholm, Gothenburg and Malmo.

The Administration is carrying out field tests on the picture phones with the L. M. Ericsson Telephone Company. The next phase of the tests will allow selected businesses to use the equipment.

Picture telephone units cost roughly the same to manufacture as colour television sets, say the Swedes, but the cost of the unit is small when compared to the cost of the communications network needed to make it work. The transmission of a good picture requires a band width of 1MHz. This corresponds to a carrier frequency which could carry over 200 regular telephone calls.



*X-RAY PANEL WITH A MEMORY. A new device called an Image Storage Panel, has been developed by Thorn Lighting, Ltd, in the UK. Its prime purpose is to cut down on x-ray radiation in airport baggage checking situations, where the image need only appear long enough to study it and no permanent record is needed. Fluoroscopes have been used, but they require that the X-ray source be on while viewing the image.*

*The panels are essentially two flat capacitor plates between which are two active layers. One becomes conductive when sensitised by x-rays; the other becomes luminous when AC mains power is applied across the plates. The panels are erased by exposure to infrared light or by heat. Photo above shows four panels.*

## World's largest balloon launched at Alice Springs

Two huge balloons — one of them bigger than any previously designed — were launched from Alice Springs last month for a team of American scientists to further their studies in radiation emission from the stars.

The balloons, launched by personnel of the Department of Supply's Balloon Launching Station in Mildura, Vic, were flown for the Massachusetts Institute of Technology, USA. The principal investigator of the team is Prof Walter E. Lewin, of the MIT Center for Space Research.

The larger balloon, having a volume of 46 million cubic ft, was constructed of about 14.8 acres of polyethylene film, and when fully inflated with helium is 500ft in diameter. At launch, the flight train was almost 800ft high.

Each flight carried a 1,000-lb payload of scientific instruments to an altitude of 150,000ft. The major instrument was an X-ray telescope which in flight automatically points itself to star sources and, like a Geiger counter in principle, measures their X-ray emissions.

Also included in the payload was the command and telemetry electronics equipment enabling ground controllers to "communicate" with the payload and command the instruments. Information from these instruments is transmitted by radio to ground receivers which, in conjunction with Bureau of Meteorology ground radar installations, are used for balloon tracking during flight.

When observations are completed (minimum of 10 hours at altitude), the flight is terminated by radio command from the ground station.

This "terminate" command severs the main connection between the balloon and payload, and through a secondary link the payload inertia tears out a destruct panel from the balloon surface. A 70-ft-diameter parachute attached to the payload then permits its safe return to earth.

During its descent the payload is constantly tracked by fixed-wing aircraft from which ground vehicles are directed to the impact site for payload recovery.

Other Australian Government agencies co-operating in this project were the Department of Civil Aviation and the Commonwealth Bureau of Meteorology.

PREPARING FOR COLOUR

# The Sony Trinitron

A recent development which seems likely to have very significant implications for the design of Australia's colour TV receivers is the Sony Corporation's Trinitron colour tube. Not only does the Trinitron produce a brighter and more sharp picture than the conventional colour tube, but it also allows a marked simplification of both circuitry and setting-up procedure. The author is co-inventor of the Trinitron.

by SENRI MIYAOKA

The Sony Corporation released a new colour picture tube called the Trinitron in Japan in April, 1968, and sold the first 13-inch colour television set using this tube at the end of the year. Its excellent colour picture quality, in brightness, resolution and contrast, became the focus of the world's attention, and already more than one and a half million television sets incorporating this tube have been manufactured and sold in two and half years in Japan, USA, Canada, UK and France. In this article, the basic electron optical principle, the mechanical structure and other features of the Trinitron are described in comparison with the three-gun shadow-mask tube which was developed by RCA and is now widely used as the conventional display device for colour receivers.

In a colour picture tube the electron gun is necessary to form the electron beam spot, and consists of cathodes which emit three electron beams, corresponding to the red, green and blue primary colours, and electron lenses which make these three beams focus on the phosphor screen; convergence devices being added to converge the focused beams onto the required points on the screen.

As its name indicates, the three-gun system consists of three independent guns which have the above functions respectively. Its electron optical system is shown in figure 1(a).

In the Trinitron tube, all of these functions are achieved by a single gun, which can emit three beams simultaneously. Some efforts have been made in the past by other workers to achieve these functions with a single gun, but no attempt was known to be successful in making the single-gun, three-beam system give better resolution because of the difficulty in focusing the electron beams which pass through the edge portion of the electron lens.

In the electron optical system of the Trinitron, all three beams pass through the centre portion of the main electron lens. In other words, they all occupy the same position in the lens.

The basic principle of the electron optical system is shown in figure 1(b). In this system, three electron beams are emitted from three cathodes in such a way that they cross one another at the centre of the main electron lens. The outside beams, diverging from the crossing point, are deflected back by a pair of electron optical "prisms" (deflectors) so that the three beams finally converge on the phosphor screen.

If an electron lens is used for this converging process, the outside beams are not only distorted by aberration resulting from astigmatism but also cannot be focused on the phosphor screen because they pass through the edge portion of this lens, which makes the image of the beam bundle of rather large cross section at the cross point where it falls on the fluorescent screen. However, the three electron beams in the Trinitron tube's electron optical system are focused sharply, since the centre of a large-aperture main electron lens serves in common to focus the three electron beams.

The electron optical system shown in figure 1(b) is utilised in 18-inch and 16-inch Trinitron tubes to give a large beam spacing at the convergence plane with a short length of gun. However, in a small sized colour picture tube in which the beam spacing is relatively small, the electron optical system can be modified, as shown in figure 1(c), in order to simplify the cathode arrangement in the gun structure.

In this system, which is utilised for 10-inch and 13-inch Trinitrons, the three cathode surfaces are in the same plane. The two outside electron beams, emitted from the same plane and in parallel with the centre beam, are both deflected towards the centre beam by a weak electron lens, called a pre-focus lens, positioned just in front of the cathodes, and the three beams are made to cross each other at the centre of the adjacent main electron lens.

Although the outside beams pass through the edge portion of the common pre-focus lens as mentioned, it has only a negligible effect in introducing aberration. In general, the aberration increases in proportion to lens strength and the spot distortion due to aberration depends on the cross section of

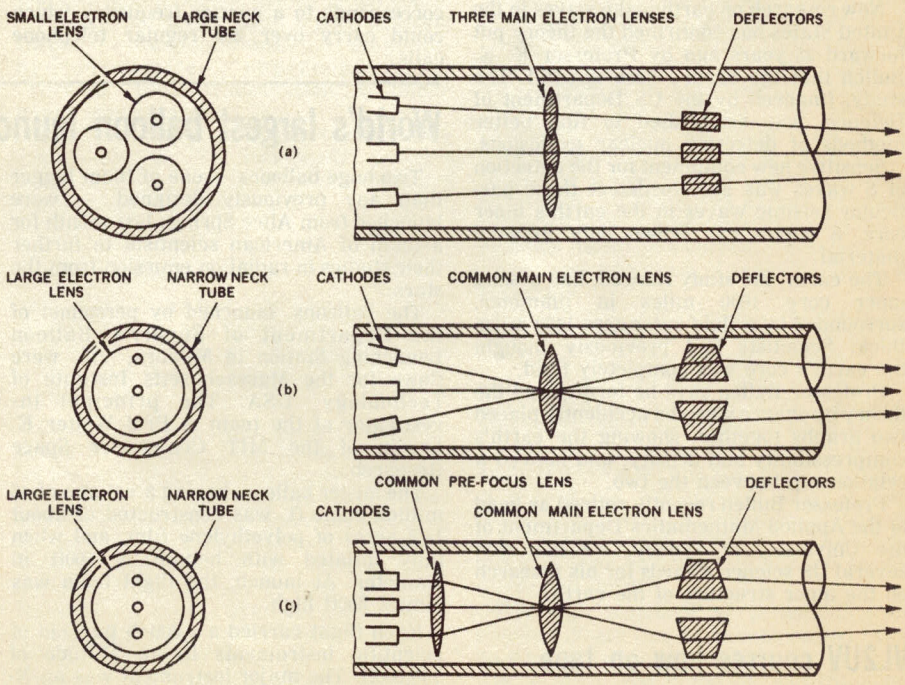
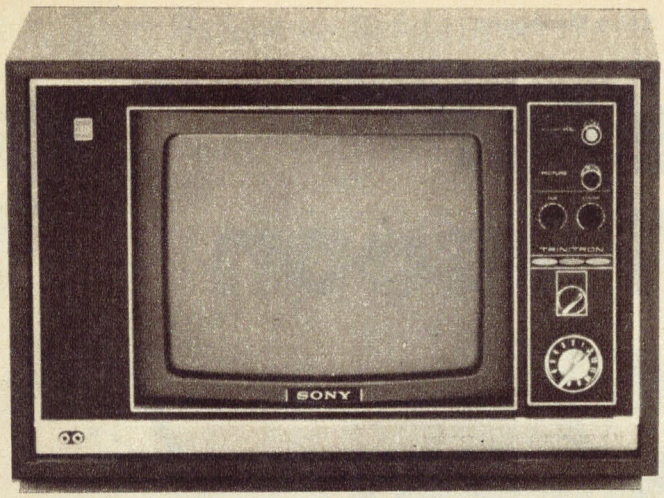



*Figure 1: Structures of electron guns of tri-colour tubes, shown in equivalent optical form. The conventional three-gun system is shown in (a), the basic Trinitron system in (b), and the modified system used in smaller Trinitron tubes in (c).*




*A late-model Sony colour receiver using the 13-inch Trinitron tube. (Courtesy Sony Corporation).*

the beam bundle at the lens position. However, this pre-focus lens is a very weak one, the deflection angle produced by it is very small, and the electron beam bundles are still very narrow when they pass through it. Therefore, the outside beam spot deformation due to the aberration is negligibly small.

A cross section of the electron gun for the 13-inch tube and its beam trajectories are shown schematically in figure 2. The pre-focus lens is formed between No. 2 grid (screen grid) and the 1st anode, and the main electron lens is formed between the 1st anode and 2nd anode. The outside beams diverging from the centre of the main electron lens are deflected by two sets of electrostatic deflector electrodes in front of the 2nd anode so that the three beam spots on the phosphor screen can be converged to one point.

Table 1 is a comparison of the electron gun system of the Trinitron and the delta-type three-gun assembly for a 13-inch colour picture tube. This table indicates that:

1. The Trinitron gun needs fewer parts than the three-gun assembly, so that its structure is simplified and its production cost can be reduced.
2. The small neck diameter of the Trinitron colour picture tube makes possible a reduction in the beam scanning power required, and allows the deflection yoke assembly to be small and light-weight. Consequently it makes transistorisation easier and also helps to reduce the size and weight of the colour television set.
3. Despite the small neck diameter, the effective electron lens diameter of the Trinitron is almost twice that of the three-gun system, because of the single gun. This large opening of the electron lens permits sharper focusing of the electron beams.

The Trinitron electron gun is a uni-potential type, using a low focus voltage of 0—300 volts, and this makes the associated circuits very simple compared with those of the three-gun system which requires 3500 to 4500 volts for focusing.

In the conventional three-gun tube, to make the best possible use of a given neck diameter the three guns are positioned in delta formation so as to permit the largest possible lens aperture. However, the adjustment of the electron beam direction in the delta-type three-gun tube is complicated because the beams emitted from the electron guns do not originate in a common plane. A certain amount of effort was made to simplify the convergence adjustment by arranging the three electron guns in line. In this case, however, the effective diameter of the guns was about 30% smaller than that of the guns in the conventional delta formation.

The diameter of the Trinitron gun is not affected by any beam arrangement, so the in-line beam arrangement has been chosen to simplify convergence correction. As a result the diameter of the electron lens can be made effectively 2.6 times that of an in-line three-gun formation.

The variation of beam spot size on the phosphor screen with beam current is shown in figure 3. This graph compares a conventional delta three-gun shadow-mask tube (13-inch, 90° deflection angle, 36mm neck diameter) with a Trinitron tube (13-inch, 90° deflection angle, 28.6mm neck diameter). The figure shows that in the Trinitron tube, a smaller spot is obtained from the centre beam than from the outside beams. It is well known that the resolution of a tri-colour picture tube is mainly determined by the resolution of the green spots. Hence the tube is designed in such a way that the centre beam impinges on the green phosphor, and the blue and red phosphors are excited by the respective outside beams to attain the highest possible resolution colour pictures.

If the beam current of a Trinitron is compared with that of a conventional delta three-gun tube for a given spot size, it will be found that the Trinitron gun can focus more beam current into that spot area. The outside beam current can be 1.5 times, and the centre beam current twice, the beam current of the delta three-gun tube for a given spot size. This means that colour pictures more than 1.5 times brighter and sharper can be obtained with the tube using the Trinitron gun.

The new electron gun is combined with a new colour defining system, called an "aperture grille", to achieve an even greater improvement in the performance of the colour picture tube. This aperture grille consists of a large number of vertical slits, formed by chemical etching of a metal sheet, whereas the shadow mask has a large number of holes evenly spread and aligned vertically and horizontally. Correspon-

**Table 1.**
**Comparison of electron gun structures of Trinitron and three-gun tubes**

| | Trinitron | Three-gun tube |
|---|---|---|
| Type of electron gun | Uni-potential | Bi-potential |
| Number of guns | 1 | 3 |
| Cathodes | 3 | 3 |
| No. 1 grids | 1 | 3 |
| No. 2 (screen) grids | 1 | 3 |
| Main focus lenses | 1 | 3 |
| Deflectors for convergence | 2 | 3 |
| Neck diameter | 28.6mm | 36.5mm |
| Effective electron lens diameter | 17mm | 9.0mm |

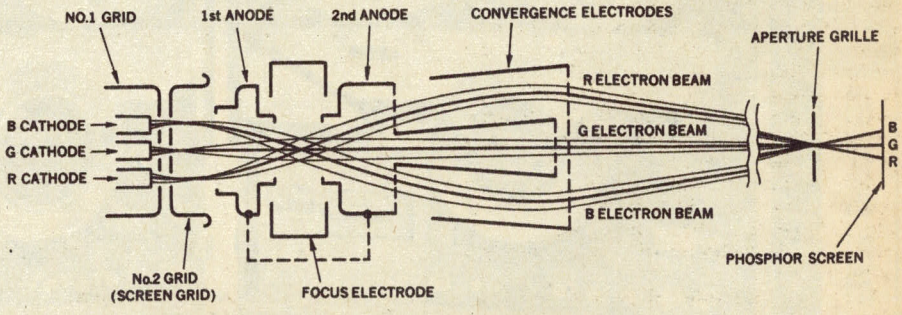



*Figure 2: Schematic horizontal cross-section of the 13-inch Trinitron electron gun and its beam trajectories.*

## ABOUT THE AUTHOR

Senri Miyaoka, who is 34, was born in Buenos Aires and studied physics at the Gakushuin University, Tokyo, Japan, obtaining his B.Sc. in 1959. He joined Sony in 1959 and developed high-frequency power silicon transistors for television receivers until the end of 1961. In 1962 he started research into various types of colour picture tube and electron guns. Co-inventor of the Trinitron, he is now assistant manager of television development. He has published several papers in the field of colour television and has many patents in Japan and foreign countries. In 1969 he received the best paper award from the Broadcast and Television Receivers group of the I.E.E.E.

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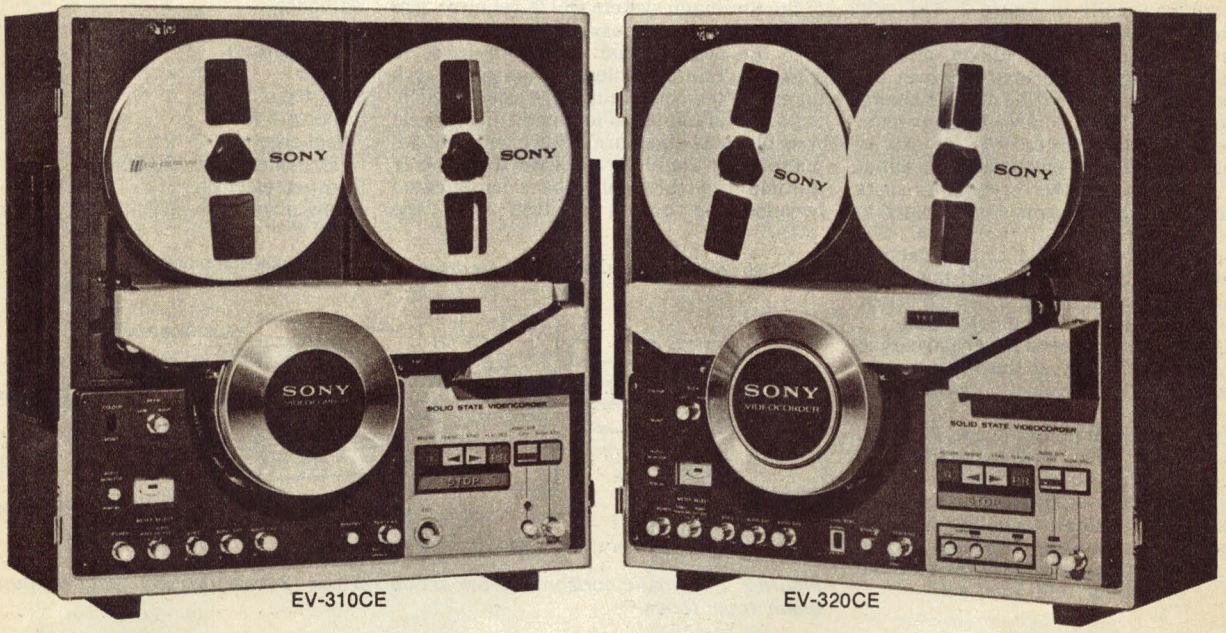


EV-310CE EV-320CE

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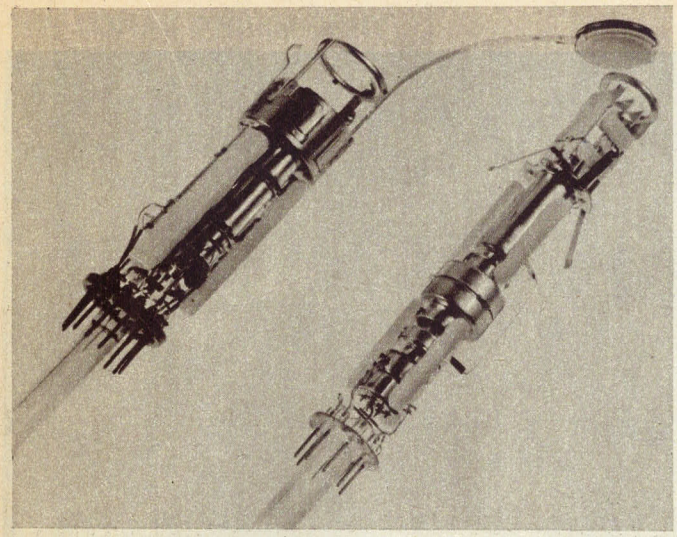
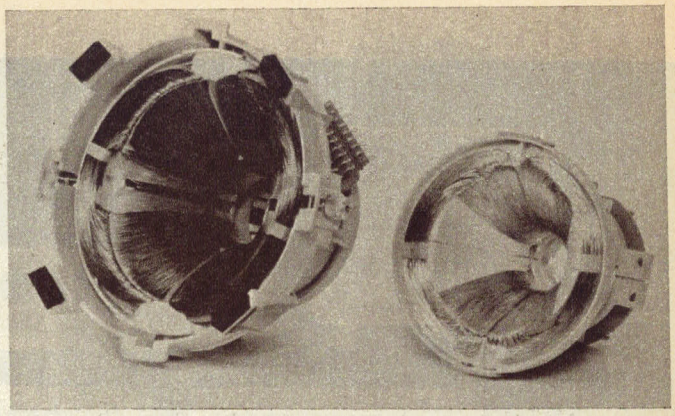




*At left is a comparison between the 13-inch Trinitron gun and that of a conventional three-gun tube (far left). Above is a similar comparison of the deflection yokes required. The Trinitron yoke at right is much smaller and simpler.*

dingly the fluorescent screen of the Trinitron consists of a large number of vertical phosphor stripes, red, green and blue, instead of the R, G, B phosphor dot triads of the shadow-mask tube. Figure 4 is a photograph of the aperture grille compared with a shadow mask. The electron beam transparency of the aperture grille is more than 20% in the central area and about 15% in the corner areas. On the other hand, the beam transparency of the shadow mask is about 15% at the centre and 11% in the corners. Therefore at a given beam current, $20 / 15 = 1.33$ times the beam current can reach the phosphor screen of the Trinitron tube, relative to the shadow-mask tube, thus giving 1.33 times the colour picture brightness. Because a 1.5 times brighter picture can be obtained with the Trinitron gun, as mentioned above, the combination of this gun with the aperture grille gives approximately twice (1.5 x 1.33) the brightness of the conventional shadow-mask picture tube.

Since there is no factor that can possibly limit the vertical detail of the images on the tube screen with the vertically slitted aperture grill, vertical resolution is determined only by the number of the scanning lines; while in the case of the shadow mask, vertical resolution is affected by the relationship between the number of the scanning lines and the spacing of the vertically aligned holes. In fact the Trinitron tube, compared with the shadow-mask tube, can display a smoother colour picture with relatively higher resolution in this respect.

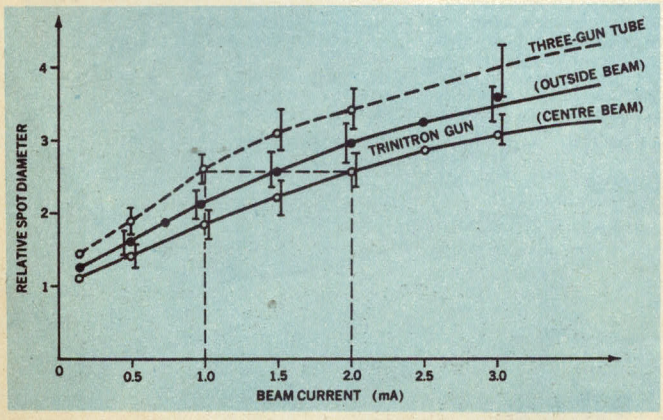
Another advantage of the aperture grille is that it is less sensitive to terrestrial magnetism, because of the vertically striped phosphors. Colour purity is not affected by changing the orientation of the colour television receiver, so the Trinitron is suitable for use in portable TV sets. Because of the aperture grille structure having no vertical components that could interfere with the scanning lines, there is no chance of generating the annoying moire pattern that can sometimes appear in the picture displayed by shadow-mask tubes.

The three beams in the Trinitron tube are aligned horizontally, and their deflected beam trajectories at any deflection angle remain substantially in a single horizontal plane. Therefore the special magnetic field distribution of the deflection yoke can make mis-convergence very small, and the mis-converged outside-beam spots on the phosphor screen are symmetrically positioned relative to the centre beam spot (see figure 5).

Correction for the mis-convergence at the corners of the phosphor screen is necessary only for the horizontal direction of the outside beams. On the other hand, the three beams in the conventional three-gun shadow-mask tube are ejected not in a single plane but in delta formation and remain so at any point on their trajectories

**Table 2.**
**Typical data of 13-inch Trinitron colour picture tube type E1AJ 330AB22.**

| | |
|---|---|
| **Optical Data** | |
| Face-plate | |
| Light transmission at centre (approx) | 48.5% |
| Screen on inner surface of face-plate | Aluminised, tricolour, phosphor stripes. |
| Phosphors | |
| Red | rare-earth |
| Blue and green | sulphide |
| **Mechanical Data** | |
| Deflection angles | |
| Diagonal | 89 |
| Horizontal | 75 |
| Vertical | 59 |
| Minimum useful screen dimensions | |
| Diagonal | 302mm (min) |
| Width | 245mm (min) |
| Height | 192mm (min) |
| **Typical Operating Conditions** | |
| Unless otherwise specified, voltages are positive with respect to No. 1 grid. | |
| Anode voltage (1st and 2nd) | 19kV |
| Convergence electrode voltage | 18.585 to 18.535kV |
| Focusing electrode voltage | 0 to 400V |
| No. 2 grid voltage | 240 to 450V |
| (when 100V applied to cathode for visual extinction of focused spot) | |
| Heater voltage | |
| Under operating conditions | 6.3V |
| Under standby conditions | 3.5 to 4.3V |



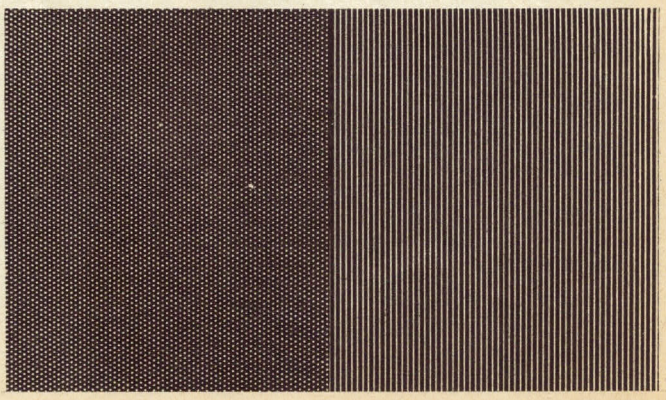
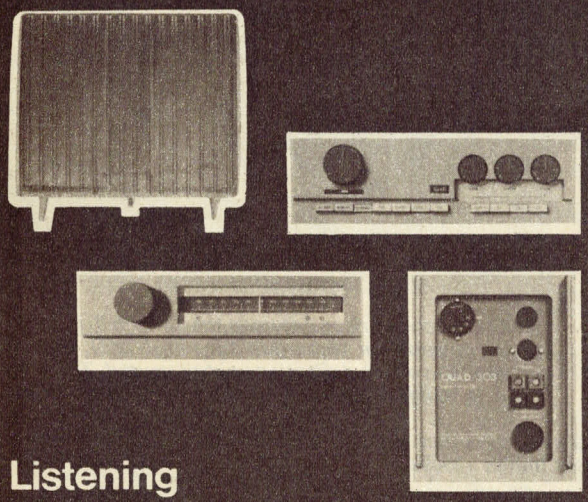



*Figure 3 (above): Variation of spot size for the Trinitron vs. a conventional 3-gun tube. Figure 4 (right): The aperture grille compared with a shadow mask.*



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When we listen we become engrossed in the music and, with good equipment, we can often obtain the same satisfaction that we would enjoy in the concert hall. Of course, there are differences between the real and the reproduced. Many of these we recognise as such; we come to terms with them and they do not intrude.

More serious perhaps are the distortions which we do not consciously notice but which are nevertheless continuously producing a contradiction between the actual and the imagined. They produce listening fatigue, a condition detrimental to the true objective. These distortions have little to do with the popular conceptions of HI-FI or LO-FI sound; on the other hand they have much to do with good or bad engineering.

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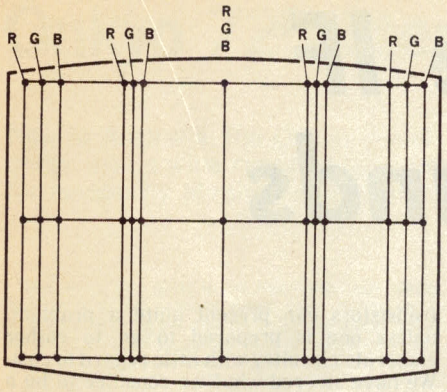
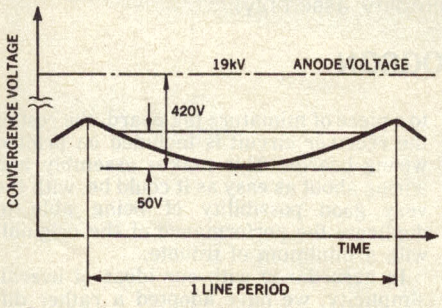



*Figure 5 (above): The effects of mis-convergence on the Trinitron are confined to the horizontal plane. Figure 6 (right): The waveform used to achieve dynamic convergence correction, applied to the deflector plates.*

cut by a transverse plane. Each beam is offset from the real centre of the three-gun assembly or the tube neck and the positional relationship of the three beams has not only a horizontal component but also a vertical component, so that convergence correction for these three beams is necessary for both the horizontal and the vertical direction. Thus convergence correction is considerably more complicated and cumbersome for the delta three-gun shadow-mask tube than for the Trinitron tube.

In the Trinitron there is a pair of symmetrical electron-optic prisms consisting of four deflection plates. Since the deflectors work on an electrostatic principle, static (centre) convergence correction for the two outside beams, red and blue, is achieved simply by adjusting the voltage applied to the deflector electrodes. The dynamic convergence correction is done by applying a synchronised voltage of parabolic waveform to the deflection plates (figure 6). As the ratio of static convergence potential difference and dynamic peak-to-peak potential difference between the deflection plates is always constant, individual adjustment of these two voltages is not necessary. Therefore if the static convergence is adjusted, the dynamic convergence will be adjusted automatically.




Comparing a typical 13-inch conventional shadow-mask receiver, for example, with a Sony 13-inch Trinitron receiver, the shadow-mask set has associated with the tube 39 electrical components and 16 adjustment points, while the Trinitron set has only 13 components and 6 adjustment points.

As is well known, the fewer the components the less the weight and cost, and as a result the greater the simplicity and the higher the reliability. It can be concluded that the most dramatic achievements of the Trinitron system are its convergence system and its picture quality. Table 2 shows typical data in the specification of a 13-inch Trinitron tube.

The principles of the Trinitron system have considerable potentialities for future development. One such line of development is to design a wide-angle deflection tube, and for this the system described would be helpful in solving many problems such as focus deterioration, increase of deflection power, and more complicated convergence correction. Application of the system is not limited to colour picture tubes with three beams. Many types of cathode-ray tubes with multiple guns and beams could be modified to single-gun types, thus simplifying their structure and improving their performance.

**This article has been reprinted from the December 1971 issue of "Wireless World", by arrangement.**

Editor's Note: Comments made by the Senior Managing Director of Sony, Mr Taketoshi Kodama, during his recent visit to Australia suggested that Sony do not intend either selling the Trinitron to other receiver makers, or granting licenses to allow other tube manufacturers to make Trinitrons until they have recouped some of the heavy R&D expenditure behind it. Nevertheless it seems likely that colour receivers with Trinitron tubes will be available in Australia by March 1975.

# Colour TV and You — continued

necessary to view the signals in colour on a normal colour set.

It is possible to build additional circuitry into a colour set so that it becomes capable of displaying the colour programs, but even so the colour locking is usually not automatic. Thus it is necessary to fit these modified receivers with some sort of control to allow the viewer to restore the colours to normal when they become out of "sync".

Naturally when proper colour transmissions commence, all colour signals transmitted will have the full colour synchronising signals necessary for the receivers to operate entirely automatically, and no viewer intervention will be necessary.

***Is colour all that important? I have heard it said about the cinema that colour will never turn a bad picture into a good one.***

Certainly colour will never turn a bad picture into a good one, but the appeal of colour to the eye is such that it can often turn a bad picture into a tolerable one. Another way of expressing this is that if one is forced to watch a bad picture, then preferably it should be a bad colour picture rather than a bad monochrome!

Almost everyone who has seen colour television in even reasonably favourable circumstances agrees that it has a "depth" and realism which far surpasses monochrome. So that a good picture in colour is even better than a good picture in monochrome, all things being equal. And for educational, training and similar purposes the additional information supplied by a colour picture makes it very much more valuable.

***How about the overall stability of colour reception? Most of us have read of overseas colour TV in which people's faces suddenly turn green, and so on. Will it be necessary to fiddle with the controls frequently?***

It shouldn't be necessary to fiddle with the controls any more than with present monochrome sets. If you're the sort of person who likes to adjust the contrast, brightness and audio tone controls of your present set, then no doubt you'll also want to adjust the controls of your colour set too. But those who like to "set and forget" will find that this will give quite satisfying reception in colour also.

In the early days of colour telecasting, quite a few of the "green faces" colour troubles originated at the stations themselves. Signal switching and distribution equipment was not capable of the performance required for handling the colour signals without phase shifts, and a shift from one camera or telecine to another would upset the overall hue of a scene. Nowadays the station equipment is very much improved, and this sort of effect is quite rare.

There is a further source of colour errors with the NTSC system of colour television used in North America and Japan, because this system is susceptible to certain types of distortion of the signal during propagation. However the PAL system which will be used in Australia is a modified version of the NTSC system which was expressly developed to be much less susceptible to this type of distortion, and the stability of PAL colour reception is of a very high order.

***Will black and white TV sets fall into disuse when colour arrives?***

If the experience of overseas countries is any guide, no. The high initial cost of colour sets will mean that some viewers will be unable to afford a colour set at all, while probably the majority of viewers will be able to afford only one colour set. Generally if there are additional receivers in a home they are monochrome, so that monochrome sets are still used quite frequently — especially portables.

***Bearing in mind the possibility of higher servicing costs, will the cost of running a colour TV set be much greater than for monochrome?***

It will no doubt be greater, but whether the difference is seen to be significant will probably depend upon your income and other commitments. The higher initial cost will for most people mean higher repayments — say by about $35-40 per year. Add to this the cost of depreciation, servicing and (probably) a more expensive licence fee, and you will perhaps be paying about $200 per year or say $4 per week more than for monochrome.

# Receiver/Tunable IF for HF or VHF bands

Here is a project which although designed especially for radio amateurs working on the VHF bands, would also be ideal for anyone seeking an easy to build basic shortwave receiver. The circuit is fully solid state, and built almost entirely on printed wiring boards to simplify assembly.

**by IAN POGSON**

The unit to be described is basically a short-wave receiver tuning from 3.5MHz to 7.5MHz. The objective was to design a unit which was economical, consistent with good performance, and still be as versatile as possible. On its own, it may be used to tune both the 3.5MHz and 7MHz amateur bands, as well as the frequency range in between these bands.

We are presenting it equipped with a mains power supply but provision is also made for battery operation. As the total quiescent current drain is only about 25mA, eight type 950 cells may be used to power the receiver purely for portable use. In addition, it may also be powered from a 12 volt car battery, with either positive or negative earth connection.

The tuning range was selected not only because it covers two of the very popular amateur bands and the interesting space in between, but because it also offered a good compromise range for use as a tunable IF for VHF converters. This may well be its primary role.

Originally, it was intended to provide only for AM reception but when the VHF bands are considered in depth, the fact emerges that many amateurs use FM. So it was decided that this should be included if at all possible. After due consideration, it was decided that the best way to provide the FM facility would be to make up a separate board with an FM IC unit. Provision has been made for this to be added, we hope in the near future.

Although we do not have much in the way of concrete plans for describing converters for use with this receiver in the immediate future, we are hoping to look into the possibility of coming up with solid state converters for 52MHz and 144MHz, as well as 14, 21 and 28MHz. This would give a complete set of receiving facilities for all the most popular amateur bands.

We can almost hear the question already: what about SSB reception? We set out originally to produce as simple a tunable IF unit as could be considered reasonably possible, and to incorporate SSB reception facilities normally complicates any receiver quite a bit. However, if the demand appears to warrant it, we would certainly take another look at the possibility of adding a BFO at least. Meanwhile, we are confident that this little receiver will neet the needs of many readers.

With the exception of the power supply, the smaller components of which are wired to a piece of miniature tag board, the rest of the receiver circuit is included on printed wiring boards. This makes assembly and wiring about as easy as it could be, with the very good possibility of being able to duplicate the performance of the original, with a minimum of trouble.

In accordance with our ideas of overall simplicity, we have adopted a rather different approach to the hardware, compared with receivers which we have described in the past. The metalwork is an adaption of that used for some of our audio equipment.

The circuit reveals that the receiver is relatively simple for the task it performs. The first stage is a mixer with a tuned circuit input, preceded by a simple 2.5K potentiometer aerial attenuator. The associated oscillator is a well tried design and very stable. Injection into the emitter of the mixer is via a small winding on the oscillator coil. This method is very efficient and the mixer-oscillator combination is somewhat easier to get going than a self-oscillating mixer.

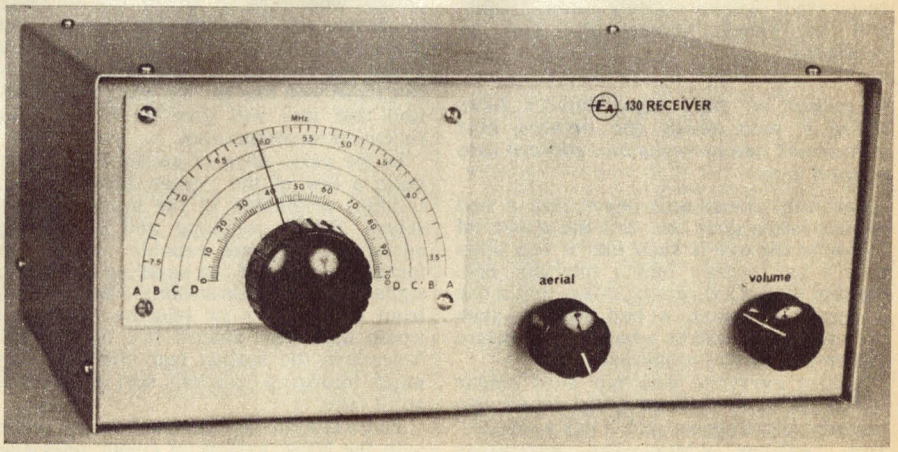
Output from the mixer is coupled into the first IF stage via a single tuned IF transformer. Coupling between the first and second IF stages and between the second IF amplifier and detector is via Murata SFD-455B ceramic filters. The detector is a transistor operated "class B", and as well as being an efficient detector, it also provides a source for the AGC system.

Providing a good AGC system for use with transistors can present quite a problem, unless one is prepared to go to rather elaborate circuitry with little regard to cost. We have steered what we consider to be a middle course and the results have turned out to be very satisfactory. Each of the two controlled IF amplifiers has a special control transistor in its emitter circuit and for the slight extra cost of the two transistors, the results are worthwhile.

The base of each of the control transistors is biased from the collector of the detector such that they are "bottomed" when no signal is present. When a signal is received, collector current of the detector increases according to the strength of the signal. This causes a voltage drop at the collector and so less current is available for the bases of the controlling transistors. As a consequence, these transistors tend to draw less current and effectively increase the resistance in the emitter of each IF amplifier. This leads to degeneration and a consequent fall in amplifier gain.

Due to the fact that the detector is used as a source of AGC, rather than adding a separate AGC generator system, the two stages of control still leave something to be desired. This system has therefore been supplemented by the technique of using a germanium diode to damp down the tuned winding of the IF transformer under very strong signal conditions. With this addition, the AGC system is able to handle a very wide range of signal strength with only a relatively small increase in audio level.

The audio amplifier is a slightly modified version of that used in our Transistor Intercom unit, described in August, 1971. The modifications are such that the amplifier may be used with a supply rail anywhere between 10 and 20 volts. The supply may even be reduced to as low as nine volts with a tolerable amount of crossover distortion.




*From this picture of our tunable IF unit, it may be seen that it is quite simple. Metalwork should be available commercially for those who want it. Dial scales ready calibrated are available through our Information Service.*

*The circuit at right is interesting on a number of points. The use of ceramic filters, the simple but effective AGC system, a highly stable VFO, and provision for battery operation.*

This has all been achieved by suitable adjustment of bias arrangements together with a limitation set on the supply to the first stage of 12 volts with a zener diode. It should be added that the preamplifier used in the intercom has been omitted.

The power supply is also quite simple, consistent with adequate voltage regulation where required. Supply to the audio stages is unregulated, with 12 volts regulated for the tuner, except for the oscillator. This has its own regulated supply of six volts. A highly stable supply is required here in the interests of frequency stability. A readily available 12.6V transformer is used, followed by a bridge rectifier, with filter, dropping resistors and zener diodes. Switching facilities are also offered for readers who wish to combine mains and battery operation.

Construction is rather different from previous receivers of this type which we have described. As we have already mentioned, printed boards are used for component assembly and wiring instead of tagboard or similar methods. Also, instead of the more conventional chassis, panel and separate metal case, we have adopted the technique which we have been using for some years for our audio amplifiers, etc. This all contributes to produce a receiver which is economical and simple to build.

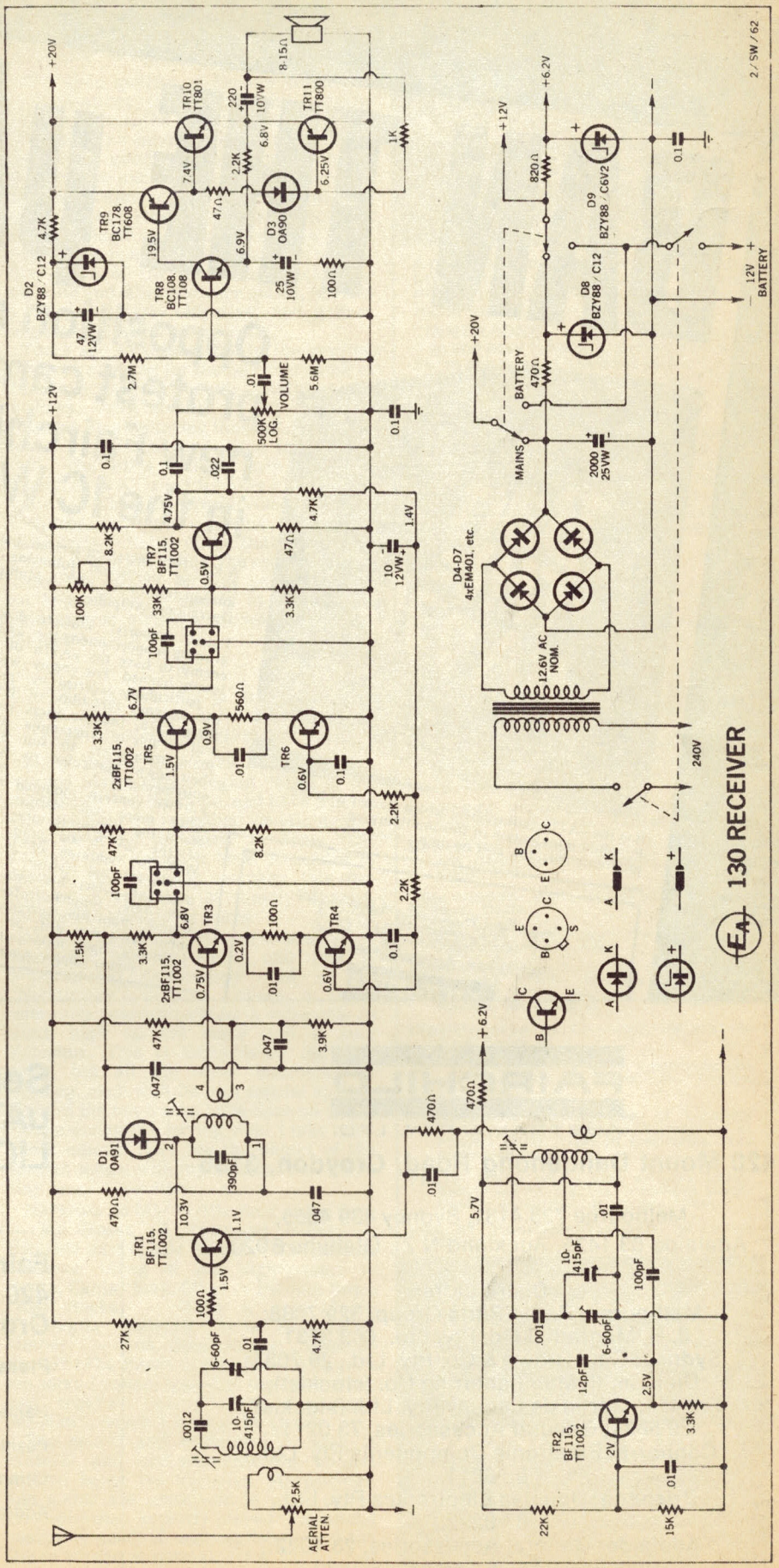
The metalwork consists basically of two "U" shaped pieces. One becomes the bottom, front panel and back panel, with all the boards and other components being mounted thereon. The other piece is a cover for the top and two ends.

The layout of the front panel naturally had to conform with internal requirements and still had to be easy and convenient to operate. The dial is located at the left, with aerial attenuator, volume control and switches located to allow for ease of operation. Space is also available for readers who may wish to add an "S meter" and more will be said about that later on.

Looking behind the front panel, it may be seen that the tuner board is immediately behind the panel and to the left. This leaves sufficient room for the audio board to be fitted to the right of the tuner board. At the rear left is the power transformer, with the wiring board carrying the rest of the power supply on the back panel. This leaves ample space on the base plate for possible future addition of an FM IF board and / or a BFO. Input and output sockets and power supply changeover switch are mounted on the back panel.

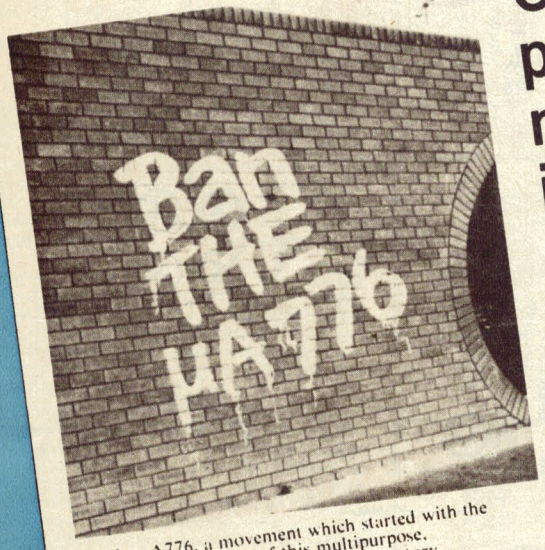
Perhaps the best place to start with the construction, is with the various sub-assemblies. There are two coils to be wound and these may be first on the list. The aerial coil consists of a primary and secondary winding, and the secondary is wound first. This consists of 45 turns, tapped at 11 turns from the bottom, of 26B&S enamel wire. The start and finish of this winding may be anchored in position with a small piece of adhesive tape. This is slipped under a few turns at each end during winding. The end protruding is then folded over the top of the winding when completed.

The tap on the coil may be effected in a number of ways. One simple method is to



# BAN THE µA776

## Opposition mounts protest campaign against new Fairchild weapon in the IC War




Ban the µA776, a movement which started with the Fairchild introduction of this multipurpose, programmable, low cost op amp — see story.

A.P.P. Fri.: Increased tension and concern are reported from all opposition following Fairchild's successful introduction of the µA776 Multipurpose Programmable Operational Amplifier.

Latest reports indicate down to ±1.2V. The growing support among the µA776 has all the features enemy to have the µA776 of an earlier Fairchild totally banned. The enemy weapon — µA741 — plus is particularly worried by 'programming capability'. the extreme versatility of It's also pin-for-pin com- the µA776, because users patible with the µA741. will be able to programme Additional support for the main parameters to suit Ban the µA776 movement their own particular re- has been gained since it quirements. was realised that Fairchild Further concern mounted have included the µA776 when more was learned in the LIC Selection Guide about the precise features which fully describes all of the µA776 op amp. their general and specific- With the addition of a purpose op amps. When simple external resistor, a questioned by A.P.P., a user can select his own Fairchild spokesman show- slew rate, frequency re- ed confident disregard for sponse, input bias current, the Ban the µA776 cam- input resistance, drift per- paign. He predicted total formance, open loop gain victory for the Fairchild and a power supply range µA776.

### FOCUS

FURTHER developments in the Ban the µA776 campaign are expected following the growing realisation that the versatile µA776 has unprecedented economical factors. Cost is less than half the price one would normally expect to pay for a product with similar specifications. 'In particular, its low voltage operation is taking an unfair advantage,' a disgruntled rank-and-file protester said.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scrape the enamel from about ⅛in of the wire at the tapping point. Another short piece of the same wire is soldered on to act as a lead. To avoid a short circuit, another small piece of adhesive tape should be placed under that turn at the tap. The primary winding of 7 turns is wound over the bottom end of the secondary, after having placed a piece of tape over that part of the secondary. Again, tape is used to anchor the winding in place.

To ensure that the windings stay firmly intact, they should now be given a coat of cellulose lacquer or other suitable material. When dry, the leads should be terminated such that when the coil is fitted to the board, the leads correspond with the relevant parts of the circuit. This is shown in the diagram.

The oscillator coil is treated in the same manner as the aerial coil, bearing in mind that the frequency stability of the receiver largely depends on this coil. It should therefore be wound firmly and finished in a workmanlike manner. The terminations are also given in the diagram.

Before the 2-gang variable capacitor can be fitted to its board, leads must be soldered to the two bottom lugs of the fixed plates. About three inches of 20 gauge tinned copper wire should be used, with a loop wound firmly around each lug before soldering. This will prevent the soldered joint from coming adrift when the other end of the lead is finally soldered to the board.

Components for the power supply, except the transformer, are wired to a miniature tag board according to the wiring diagram. The mains leads are terminated on the board and then run to the switch and on to the transformer primary. The switch to change over from mains to battery operation is also wired according to the diagram but the lead which goes to the +12V battery does not terminate on the board, being run directly from the appropriate terminal on the socket.

While we are on the subject of switches, it should be noted that there is a double pole switch on the volume control potentiometer, one pole of the switch is used for breaking the mains and the other pole is used for the battery.

When a battery is used, the mains lead will be removed from its socket, and vice versa. Readers who do not wish to use the battery facility, may omit the switch and simply make the necessary modifications to the wiring. The battery socket on the back panel will also be omitted. On the other hand, for those who wish to use batteries only, the mains transformer with its socket, together with the rectifier diodes, the 2000uF capacitor and the 12V zener may be omitted and the wiring modified to suit.

Before attempting to assemble the audio amplifier board, it should be noted that this board was designed for other projects and as this receiver is designed to operate from either a positive or negative grounded car battery, it is necessary to remove a little of the copper from the board before assembly. The copper to be removed comprises the small area around each of the two mounting holes. Sufficient copper must be removed with a razor blade or other suitable instrument, such that when the board is mounted to the metal cabinet, the screws do not make contact with the copper on the board.

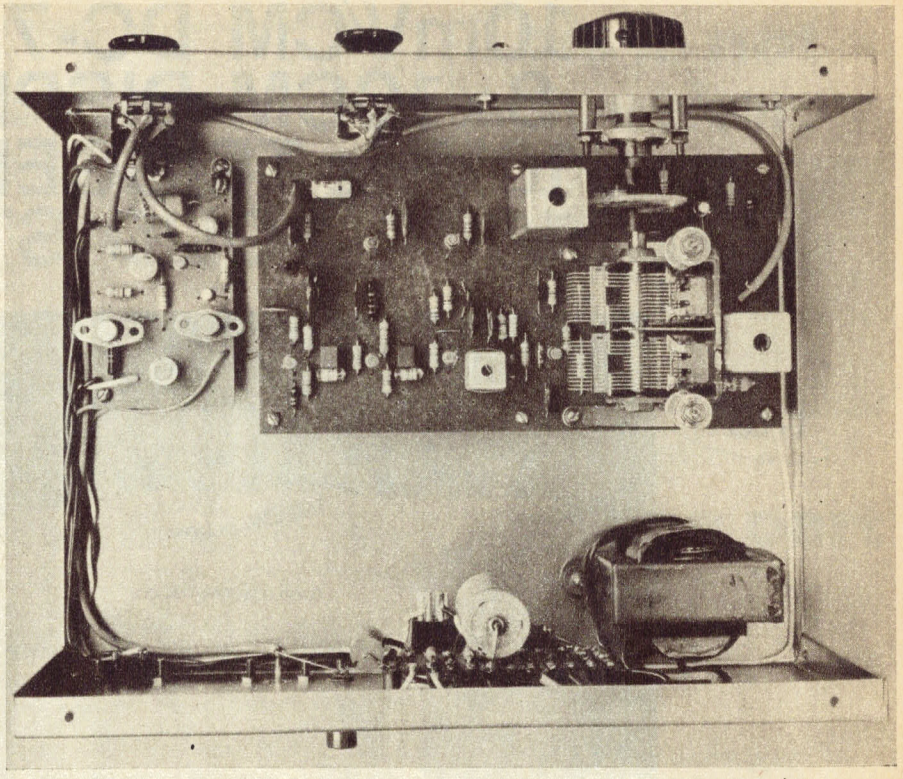
The space provided on the board for a preamplifier is not required for the receiver, and is therefore left blank.

An addition to the audio board specially for this receiver is the 12V zener diode, and we added ours on the copper side of the board, just underneath the 47uF electrolytic capacitor. Another point worth noting is that we used a pair of output transistors which are no longer available in the physical form as shown in the picture. Our transistors have a mounting flange, but these are not required in this circuit and the transistors are otherwise identical to ITT types TT801 and TT800. Apart from these points, the board is quite straightforward.

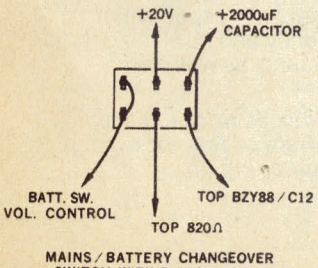
The largest and perhaps the most interesting sub-assembly is the tuner board. Although this board is also fairly straightforward, it is advisable to approach construction in a systematic manner. A logical place to start would be to fix all resistors and follow up with capacitors and other small items, including the transistors. These are followed by the IF transformer, variable capacitor and finally the two large coils in cans. These coils must be carefully sited with respect to lead terminations and function.

A trimmer must be soldered to each section of the variable capacitor and as may be seen in the picture, we used the old type Philips "beehive" trimmers. These are still available from a number of sources but if you are unable to get this type, or if you prefer the new solid dielectric type, then by all means use them. Care should be taken when soldering the latter units in place, making sure that a good soldered joint is made in each case, without damaging the trimmer by burning or overheating.

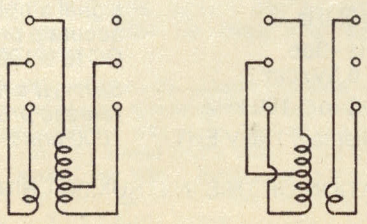
Having made ready all the sub-assemblies, these may now be fixed to the main case. To make the job easy, assembly should be done in a logical sequence. This is how we did it. The aerial terminal and all sockets are fitted to the back panel, followed by the mains transformer. Leads of sufficient length are soldered to the change-over switch, according to the diagram. The switch is then mounted such that when the toggle is pointing to the appropriate input socket, mains or battery, this is the mode of operation selected.



*This view of the interior shows clearly the layout of the various sections. Note particularly the placement of the power supply board and sockets on the rear panel.*




MAINS/BATTERY CHANGEOVER SWITCH WIRING FROM REAR



COIL CONNECTIONS VIEWED FROM ABOVE

*As the switch for selecting mains or battery operation is rather tricky to wire, a sketch is shown at left. Terminations for the aerial and VFO coils are shown at right.*

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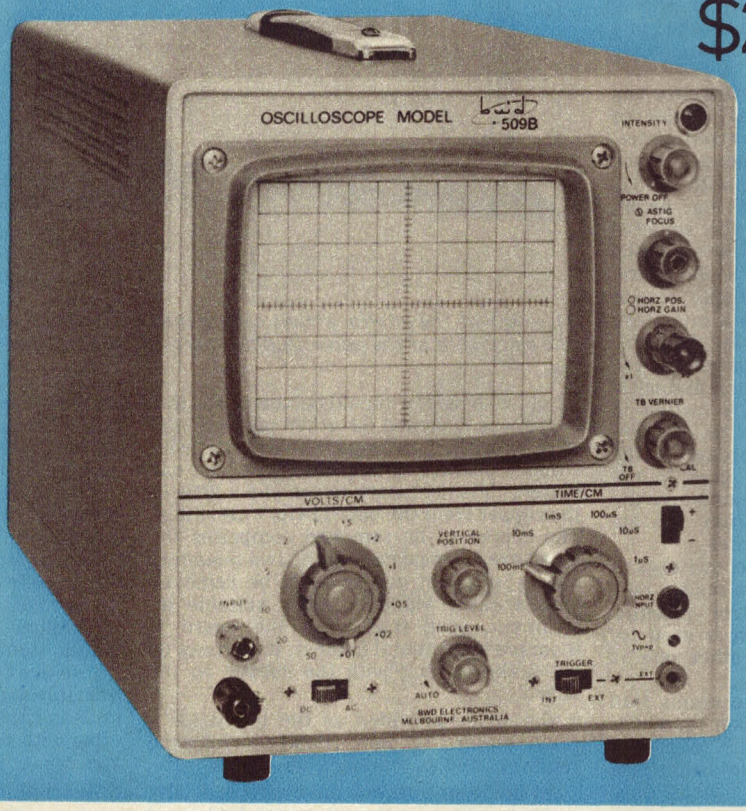


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| MAG.: | x1 to x5 (calibrated). |
| TRIGGERING: | 3Hz to >10MHz. |
| AMPLIFIER: | DC - 1MHz –3db. 600mV to 6.5V/cm. |
| X-Y PHASE: | 1° from DC to >100 kHz. |
| CRT: | 8x10cm display, 1.6kV EHT. |

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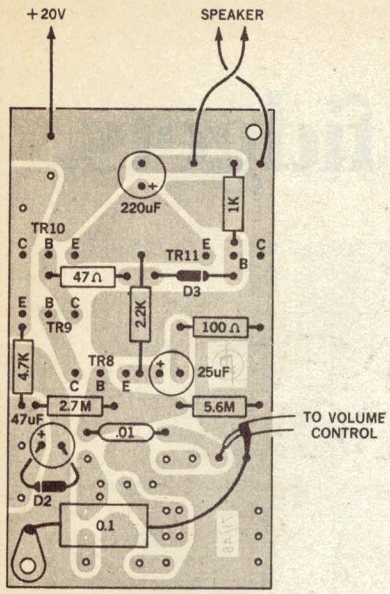
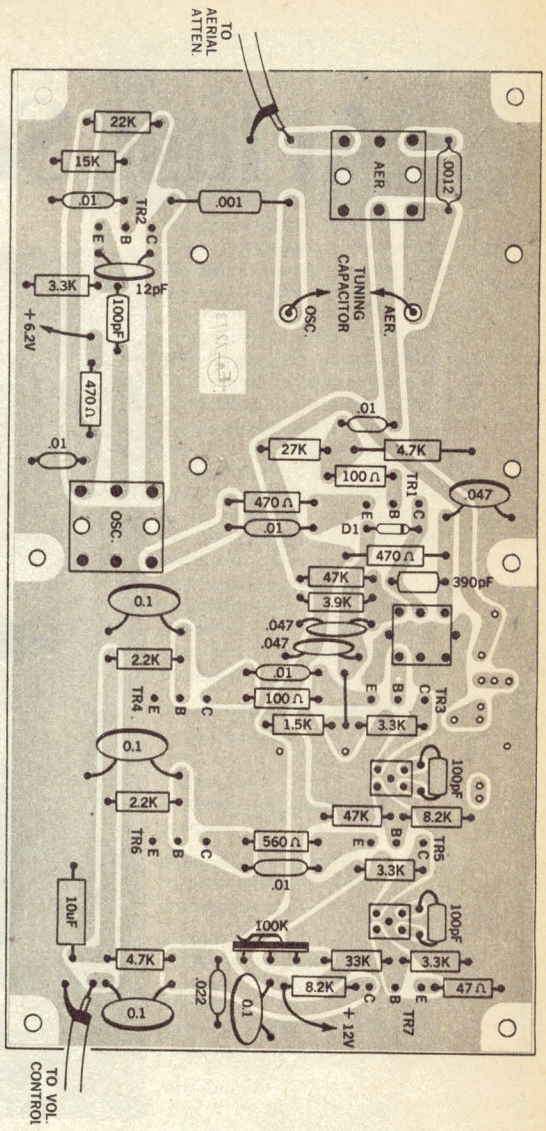
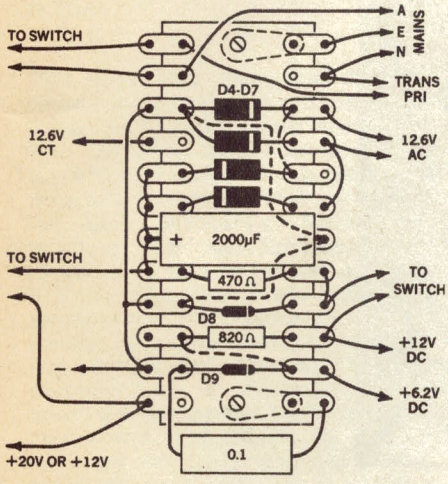



*The audio board is quite easy to assemble but it should be noted that a zener diode is mounted on the copper side. For normal operation, heat sinks should not be required for the output stage.*




*The tuner board is shown at the right and like the audio board, is shown from the component side, with the copper shown "ghosted". The unused holes are for the addition of an emitter follower later on.*




*The power supply panel is simple enough to follow but due care should be given to accuracy and the fact that the negative line is not earthed to the main frame.*

The power supply board is mounted on the back panel and when doing so, care should be taken to ensure that the terminal on the board for the mains earth is securely connected electrically to the case. A shakeproof washer under the mounting screw will help here. Interwiring between the components already mounted may now be done.

Before fixing the audio board in place, make sure that leads are provided for the speaker socket, 20V supply, negative lead and shielded lead for the volume control. The board is now fixed in place, together with the volume control on the front panel. At this stage, and at frequent intervals during wiring, checks should be made to ensure that the negative supply line does not become shorted to the main case. Wiring between the audio board and other points may now be done. At this point and after a thorough check, power may be applied to see if all is well. A finger applied to the input to the volume control should show that the audio section is working.

The aerial attenuator is screwed to the front panel and then the tuner board mounted. This must have external leads fitted for the 12 volt and 6 volt supplies and shielded leads each to the volume control and aerial attenuator. With the board screwed into place, these leads are connected up. A shielded lead is then run from the aerial attenuator to the aerial coaxial socket, which is also connected to the aerial terminal.

When wiring in the shielded leads, do not connect the shield braid of any lead to the metal cover of the control. The shields should be connected to the appropriate lugs on these controls, however. Also, the shield of the aerial lead to the coaxial socket should be cut off at this end and not terminated. These precautions are necessary to allow the receiver to be used with battery supplies having either polarity grounded.

The dial assembly is mounted on the front panel with four screws and concurrently with this operation, the drive is lined up with the flexible coupling to the gang. A short piece of steel or brass ¼in diameter rod will be needed between the dial drive and the coupling. The coupling should be carefully tightened to the shafts, making sure that there is no strain and with the dial pointer at 100 when the gang is fully closed.

In addition to the 0.1uF capacitor between the negative line and the case mounted on the power supply board, we have found it also desirable to add another one on the audio board. This is connected from the negative line where the audio input shield is connected, across the other side of the board to a lug under the fixing screw, which in turn connects it to the case.

It may be noted at this stage, after mounting all the main components into the case that there is quite a bit of spare space. This has been provided so that additions such as an FM assembly may be added later and possibly other additions which we or readers may see fit to add in the future.

More than likely, manufacturers such as Heating Systems Pty Ltd will make metalwork available and this should be available through the normal channels. In some instances, four dimples are pressed into the bottom of the case but if these are not provided, then four small rubber feet may be fixed to the bottom of the case, near each corner.

At this stage, the receiver is virtually finished and before final adjustments are made, all wiring should be carefully checked to make sure that there are no mistakes or omissions. This applies particularly to switching and plug and socket connections. Another point to check and one which we mentioned earlier, is that the

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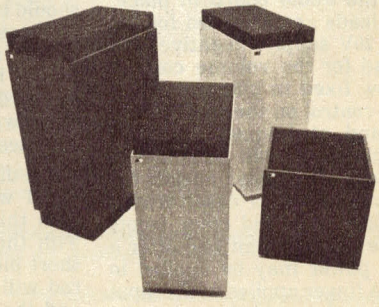

## Sonab

Sonab of Sweden Pty. Ltd., 114 Walker Street, North Sydney, N.S.W. 2060. Telephone: 929 4288/4554.

## PARTS LIST

1 Chassis, 10½in wide x 8¼in deep x 4½in high
1 Cover to suit
4 Rubber feet
1 Power transformer, 240V to 12.6V, PF1728, PF2565, PT2150 or similar
1 Dual ratio dial assembly (Jabel)
1 Toggle switch, miniature DPDT
1 Coaxial socket
1 Aerial terminal
1 Plug and socket, Bulgin P360 3-pin
1 Plug and socket, Bulgin P73 6-pin
1 2-pin miniature speaker socket
2 Knobs
1 ¼in x ¼in insulated flexible coupling
1 ¼in dia x ¾in long brass or steel shaft
1 Miniature tag board, 12prs tags
10 Brass spacers, ½in long x ¼in dia, tapped ⅛in Whit.
1 Printed board, 7½in x 4in, 72/T3
1 Printed board, 3⅝in x 2in, 71/A8
2 Neosid coil formers, 7.6mm x 2½in, with grade 900 slug and can
1 Aegis ST45C IF transformer
2 Murata ceramic resonators, type SFD-455B

SEMICONDUCTORS

7 Transistors, BF115, TT1002, etc
1 Transistor, BC108, TT108, etc
1 Transistor, BC178, TT608, etc
2 Transistors, TT801, TT800 or AY6108, AY6109 (matched pair)
4 Diodes, EM401, etc
1 Diode, OA90
1 Diode, OA91
2 Zener diodes, BZY88/C12
1 Zener diode, BZY88/C6V2

RESISTORS (½W unless stated otherwise)

| | |
|---|---|
| 2 47 ohms | 1 560 ohms |
| 3 100 ohms | 1 820 ohms |
| 4 470 ohms | 1 1K |
| 1 1.5K | 1 22K |
| 3 2.2K | 1 27K |
| 4 3.3K | 1 33K |
| 1 3.9K | 2 47K |
| 3 4.7K | 1 2.7M |
| 2 8.2K | 1 5.6M |
| 1 15K | |

1 2.5K linear potentiometer
1 100K tab potentiometer
1 500K log potentiometer with DPST switch

CAPACITORS

1 12pF NPO ceramic
2 60pF Philips trimmers
3 100pF 630V polystyrene
1 415PF Roblan 2-gang variable
1 .001uF 400V polyester or polystyrene
1 .0012uF 400V polyester or polystyrene
7 .01uF 100V polyester
1 .002uF 100V polyester
3 .047uF 25V ceramic
4 0.1uF 25V ceramic
2 0.1uF 160V polyester
1 10uF 12VW electro
1 25uF 10VW electro
1 47uF 12VW electro
1 220uF 10VW electro
1 2000uF 25VW electro

MISCELLANEOUS

Hookup wire, 1 yd light coax cable, solder screws, nuts, solder lugs, power flex and plug, etc.

Note: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

negative line of the system is isolated from the case.

Satisfied that all is well so far, power may be applied and an inspection made for signs of distress. It may also be a good idea at this stage to check the three voltages from the power supply. The 100K potentiometer in the bias circuit of the detector may be set tentatively to give a reading of 4.75V at the collector. This adjustment will subsequently be adjusted to give best results on a weak signal.

Before proceeding with the alignment, a word or two about the dial scale. The dial assembly used on the prototype is marketed by Messrs Watkin Wynne. The dial has a logging scale calibrated from 0-100 and there are also four blank scales. We have calibrated one of the blanks according to the basic range covered, ie, from 3.5 to 7.5MHz. Copies of this scale may be had through the Information Service for $1.00 each. The alternative would be to calibrate your own during the alignment process. We should also add that when this receiver is used as a tunable IF for converters, then the remaining blank scales may be calibrated to suit.

Alignment is best carried out with the aid of a signal generator. Set the generator to 3.5MHz and connect the output to the aerial terminal. Set the dial on the receiver to 3.5MHz, or 95 on the logging scale. Adjust the slug in the oscillator coil so that the signal is heard. Then adjust the slug in the aerial coil for maximum response and adjust the slug in the IF transformer for maximum response. During this process, the output of the generator should be progressively reduced and kept at such a level as to simulate a fairly weak signal.

Set the generator to 7.5MHz and the receiver to 7.5MHz, or 5 on the logging scale. Adjust the trimmer on the oscillator section of the gang until the signal is heard

*(Continued on page 125)*

# Radionic X30 – a 'printed circuit' educational hobby kit

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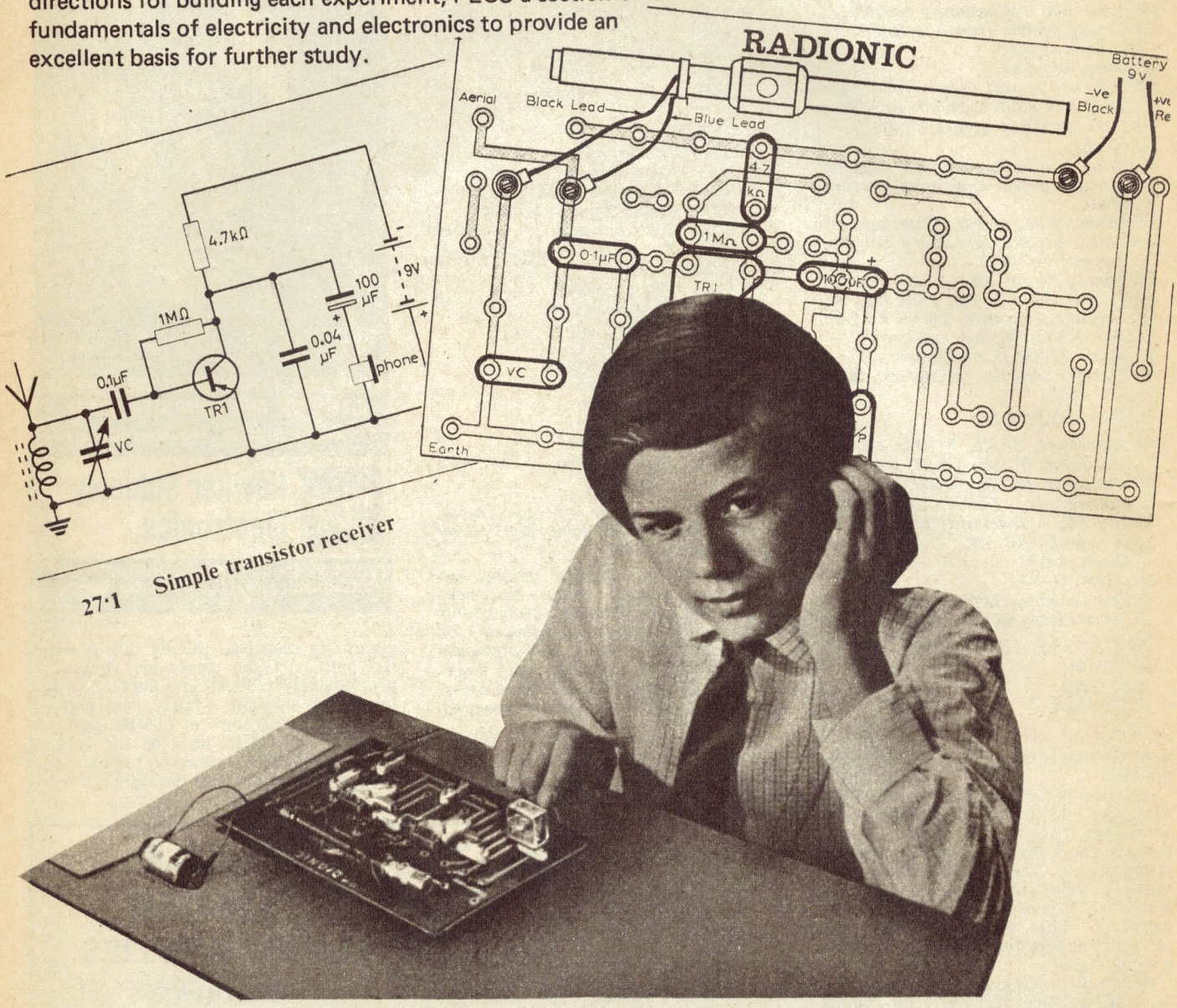


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# Reliability and Maintenance

Reliability and ease of maintenance are important considerations in the design of any equipment. In this brief article the author examines the practical approach to these aspects for electronic equipment design.

**by K. H. WILLIAMSON**

Head of Circuit Design Department
Electrical Research Association, Surrey, England.

Although capital cost is the main criterion in the design of commercial electronic equipment, the trend towards greater complexity makes the reliability aspect increasingly important so as to minimise time spent on maintenance. If electronic equipment could be made totally reliable, and routine maintenance were not required, considerations of accessibility and replaceability would not arise. Modern semiconductor devices can offer extremely high reliability, but the level is not yet sufficient to make these considerations immaterial.

The factor of reliability of a piece of electronic equipment (usually given as percentage failure / 1000 hours) is the sum of the reliability figures of all its component parts. Technological progress is improving these figures all the time: for instance, solid-state silicon integrated circuits are more reliable than discrete solid-state component circuits and these are much more reliable than thermionic valve circuits.

From the point of view of maintenance, it is only necessary to know which types of component are more reliable than others, when specifying new equipment. A comparison of selected component-reliability figures would enable certain broad conclusions to be drawn, such as that wrapped joints are 10 times more reliable than soldered joints, silicon rectifiers are 20 times better than valve rectifiers, and transistors are 22 times more reliable than triode valves.

Ready availability of spares is important: it is a good insurance to keep replacements of components that are known to be statistically unreliable, as it is wise to keep a list of equivalent components for use in an emergency. By the time equipment is in need of maintenance or repair, vital components may well be obsolete, compelling the equipment to be scrapped unless this situation was foreseen and judiciously provided for.

Where continuity of service is essential, such as in a production line, electronic sub-units performing key functions in equipment should have automatic standby replacements, and some means of indication that a changeover has taken place. The faulty sub-unit can be changed later, at a convenient opportunity. Whether it will then be repaired or discarded will clearly depend mainly on the ratio of repair cost to the cost of a new unit.

If cost were of no consequence it would be possible to ensure almost complete reliability of equipment within a limited working time-span. But, as already stated, cost is highly significant in most applications, and provision of elaborate safeguards is not economical; hence, it has to be accepted that failures will ultimately occur. It is then that accessibility becomes important.

There are two basic ways of making component parts accessible: adoption of modular construction (each module removable); and provision of folding cabinets (units hinged). Each has advantages and disadvantages, when used in isolation. For example, the first offers easily replaceable units but needs sliding connectors. The second allows easy access to the system for checking but may not be convenient for changing components. A combination of the two methods is therefore gaining acceptance as being best from a maintenance point of view.

Using present-day techniques, the most reliable and accessible equipment would then consist of a folding structure to allow easy access, modular circuits using printed-circuit boards, and a minimum number of sliding-contact connectors.

The various forms of hardware and their effect on reliability, replaceability and accessibility can now be reviewed. For this purpose, hardware in electronic equipment may be divided into four categories, each providing distinctive problems and requiring particular techniques: components; connections; connectors; and cases.

### 1. COMPONENTS

Solid-state devices are by far the most reliable of the active components. They are normally formed from single pieces of silicon and are, therefore, as mechanically strong as the silicon. Suitably encapsulated diodes or rectifiers can withstand forces up to 10,000 times the acceleration due to gravity.

The potentially long life of solid-state devices means that manufacturers must carry out extensive quality-control procedures to ensure that inferior workmanship will not be a cause of failure. In turn, the designer of circuits should ensure that all selected components are used within their rated values and to manufacturers' published data. In thermionic valve equipment, failure is most likely to be caused by a valve, but in solid-state circuits it is more likely to be due to failure of a passive component or a connection, not because these are more likely to fail but because there are usually more passive components in a circuit than active devices.

Silicon integrated circuits are bringing solid-state reliability to entire and relatively complex circuits. An integrated circuit containing the equivalent of 100 components, active and passive, can be at least 100 times more reliable than a single thermionic valve. Large-scale integrated (LSI) circuits, where many functions are performed on a single chip of silicon, are introducing even greater reliability.

So far, we have considered only the low-current-level areas of electronic maintenance, but solid-state reliability is, of course, well established in power control systems also. The thyristor is the solid-state replacement of the thyratron and whereas the latter had a limited lifetime — as well as a relatively high failure rate, even compared with ordinary valves — the thyristor, in common with other solid-state devices, has an indefinite life. Thyristor devices are now being used in almost all areas of power control applications.

The high integrity of active components is making passive components like resistors, capacitors and inductors seem unreliable in comparison. However, there have been considerable advances in materials and manufacturing techniques and these are being applied in efforts to make passive components compatible in both reliability and miniaturisation.

### 2. CONNECTIONS

Printed wiring boards have been in existence for over 20 years and, apart from integrated circuits, are probably responsible for the biggest advance in interconnection reliability. Since solid-state circuits are normally built from miniaturised components, the wiring board serves as the mounting for the components as well as a means of interconnection. This has greatly simplified and strengthened the circuitry and made modularisation both easy to obtain and a desirable method of building equipment. It is now much easier to divide a large circuit into function blocks than it was when valves and other relatively large components were mounted on metal chassis.

The rugged construction of the printed wiring board, together with the ease of soldering components and inspecting the final circuit, has made the printed wiring technique generally acceptable for most electronic circuits. Connections from board to board, board to switch, and so on can be made in various ways, but wrapped joints and flexible printed wiring are being used increasingly, especially in large, complex circuits.

### 3. CONNECTORS

Connectors with sliding contacts are a necessary evil. They are the only way of making and breaking interconnections rapidly and hence are necessary to the philosophy of replaceable modules in equipment.

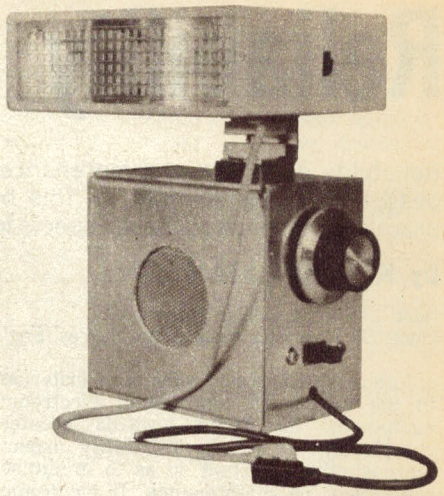
Manufacturers have developed connectors in various forms and to a reasonable standard of reliability. However, as they add nothing to the function of a circuit, being there only for convenience, their use should be kept to a minimum.

### 4. INSTRUMENT CASES

If a case or cabinet containing electronic circuits is structurally sound and allows sufficient ventilation, then its only other requirement — apart from looking at-

*(Continued on page 125)*

# SOUND TRIGGERED PHOTO-FLASH



Here is a simple and easily built little unit which will trigger an electronic flash gun in response to a sound or noise. Because of its high sensitivity it can be used to obtain dramatic stop-motion shots and a variety of other photographic tricks.

by W. LANGLEY

Many readers will have an interest in photography as well as in electronics and the device described here will enable some interesting and unusual shots to be taken. The total cost of building the sound triggered flash unit described here is not high and money will not be wasted even if only a few shots are attempted. Note that this device is only suitable for electronic flash guns and although it should be possible to arrange for the SCR to apply a voltage to a flash bulb, this has not been tried.

Those who have commented on the unit have suggested that it could have applications as a burglar alarm; the sensitivity can be set to such a level that a flash will be produced by the noise made by a burglar. This should certainly be a strong deterrent and it has few of the disadvantages of the conventional type of bell-type burglar alarm since accidental triggering will not be so objectionable or so serious. If this is attempted a mains power supply giving 9V DC will be needed for the trigger unit as the batteries will not last all that long under continuous operation.

The sensitivity of the unit is variable over a considerable range, a feature very necessary for a device of this type.

The complete circuit is shown in figure 1 and is basically a DC coupled amplifier. Instead of a conventional microphone, a small high impedance loudspeaker is used in reverse as the transducer. This is very sensitive and rather cheaper than a microphone. However, this has to be coupled to a low impedance input to provide a decent match and so it is connected to the emitter of a common-base transistor configuration. The typical input impedance of such a stage is about 50 ohms and so a good match is achieved; there is also high voltage gain in such a stage.

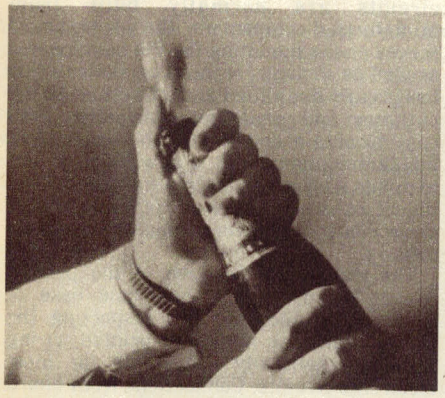
R1 acts as the collector load and the signal is applied directly to the base of TR2 which is arranged as a conventional common-emitter amplifier. Base bias for Tr1 is taken from the emitter of Tr2 via R2. C1 stabilises the base voltage of Tr1 and C2 decouples R3, so preventing negative feedback from reducing the gain. By arranging the base bias for the first transistor in this way, DC stabilisation is achieved.

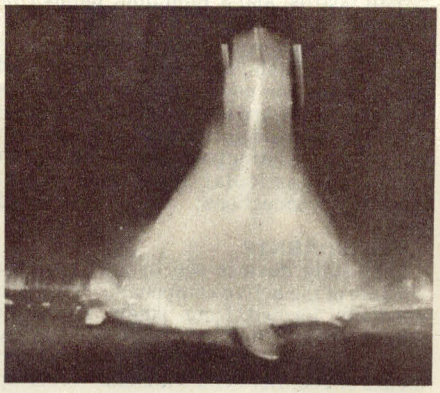
The collector load of Tr2 is VR1, a 100ohm wirewound potentiometer; by varying this the bias level for the third transistor is controlled and this effects the sensitivity. If the value of VR1 is very low, Tr3 will only conduct when relatively high currents pass through it. If VR1 is set to such a level that Tr3 is nearly conducting, the slightest increase in current will switch it on.

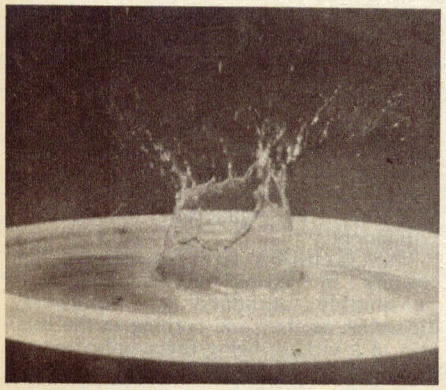
The collector load of Tr3 is R5 and it is the voltages developed across this that control the operation of the circuit.

## PARTS LIST

*1 Case, as described.*
*1 Loudspeaker, 25-80 ohm miniature type.*
*1 Slider switch, on-off.*
*1 Miniature 9V battery and connector lead.*
*RESISTORS*
*All 1/8, 1/4 or 1/2 watt, 5 or 10% type.*
*1 x 47 ohm, 1 x 330 ohm, 1 x 470 ohm, 1 x 1K, 1 x 10K, 1 x 68K 1 x 100 ohm wirewound pot.*
*SEMICONDUCTORS*
*2 x BC169C or similar.*
*1 x 2N3702, TT608, 2N3638A or similar.*
*1 x CRS1/05, C106B2, BT100A/300R, 2SF106 or similar.*
*CAPACITORS*
*2 30uF 10VW electrolytic.*







*These experimental shots taken using the prototype illustrate its action. Top left shows a champagne cork leaving the bottle, the "pop" triggering the flash. Top right is a light bulb at the instant of shattering. Bottom left is the splash of a ball hitting water, while the final shot is of a balloon in the process of bursting after falling on some pins. Note that the top is still in its stretched shape.*

The potential at the collector of Tr3 is applied to the gate of the SCR via R6.

With VR1 set at the correct position, Tr3 will only conduct sufficiently on high peaks of sound and in some ways it is acting as a limiter.

The switch contacts of the flash gun must be wired the correct way around across the SCR. If there is any doubt about which is positive (which connects to the anode) this can be measured using the volts range of a multimeter.

With insufficient potential applied to the gate of the SCR, this device acts as a very high resistance across the flash trigger connections. However its resistance falls to practically nothing as soon as the potential on the gate reaches the necessary level.

When a sound wave of the required level strikes the cone of the loudspeaker, a small potential is developed in the speech coil causing Tr1 to conduct more which in turn causes Tr2 to pass more current, increasing

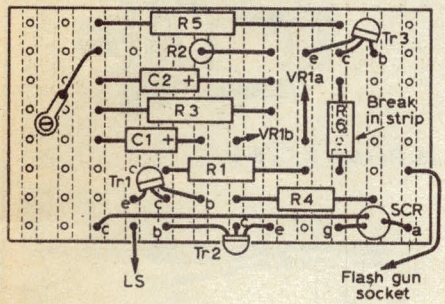



*Figure 2: The component layout, on Veroboard. The long wire connecting to the SCR cathode should be sleeved.*

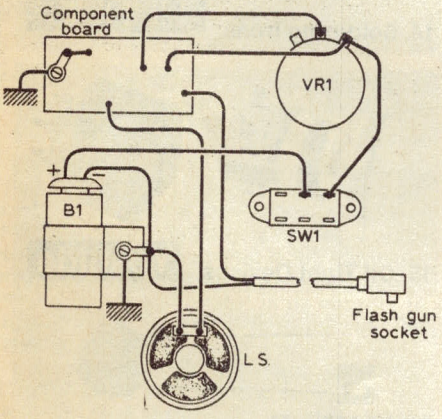


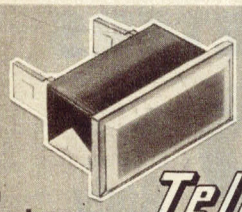

*Figure 4: Overall wiring details.*

the potential across VR1. As VR1 forms part of the base-emitter circuit of Tr3, as soon as the potential in that circuit exceeds about 0.6V (silicon transistors are used here), Tr3 conducts causing the voltage at the junction of R5 and R6 to rise to or above the critical level and the SCR is switched on. And this is equivalent to closure of the normal camera contacts; i.e., it triggers the flash unit.

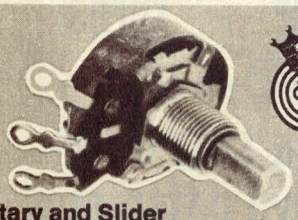
One of the characteristics of the SCR is that it remains on even if the gate triggering voltage is removed and it can only revert to its high resistance state when the potential across the anode and cathode (marked a and c in figure) is removed. The potential is removed when the flash occurs and so the SCR automatically reverts to its non-conducting state.

The 9V supply is provided by a small PP3

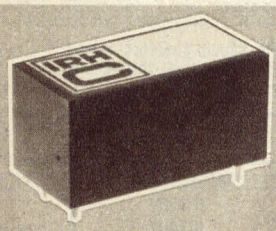
# components with a purpose *



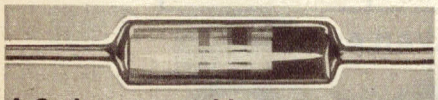
1. Neon Indicator Lamps. Telite



2. Rotary and Slider Potentiometer Single and Stereo.



3. Reed Relays.



4. Carbon composition and Metalglaze precision Film Resistors.

5. Wirewound Resistors.

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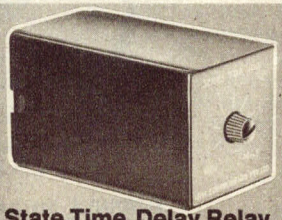
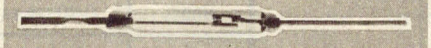
6. Ceramic I.F. Filters *Actual Size.*

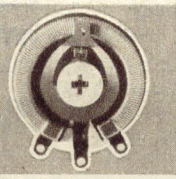
7. A switch for every application. NKK



8. Solid State Time Delay Relay.



9. Magnetic Reed Switches. HAMLIN



10. Power Rheostats.

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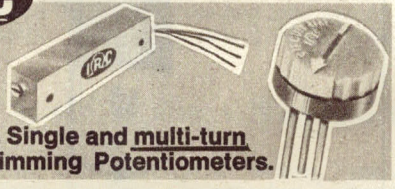
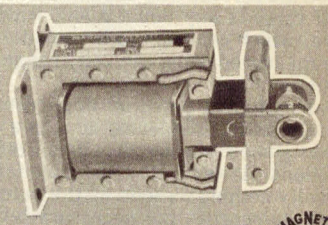
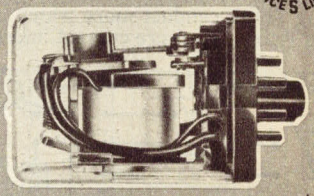


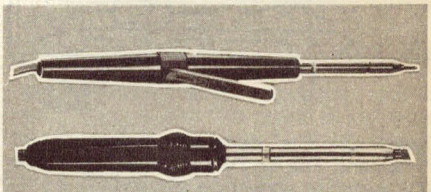
11. Single and multi-turn Trimming Potentiometers.



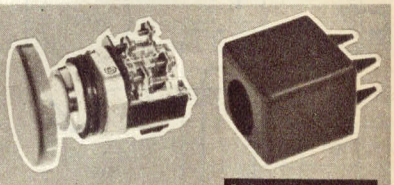
12. Solenoids. MAGNETIC DEVICES LIMITED



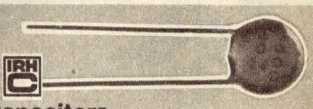
13. Relays A.C. & D.C.



14. Soldering Irons. SCOPE



15. Oil Tight Devices. Yoshida



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battery which is quite sufficient to operate the trigger unit.

The majority of the components can be mounted on a small piece of Veroboard, 0.15in. matrix, 12 x 8 holes, the copper conductor strips running across the short way. Clearance is provided at one end to allow for the fitting of an aluminium angle bracket which holds the component board inside the chassis. Only one break in the conductor strip is necessary, this being underneath R6. The layout is shown in figure 2.

Five connections are needed to the component board. One is provided by a short wire fitted with a solder tag which connects to the negative strip. This solder tag fits under the mounting screw and this provides the negative supply line. There are four other connections and Veropins can be inserted to provide these. Two of these go to VR1, one to the loudspeaker and the fourth directly to the flash gun socket.

The circuit can be built into a small aluminium chassis fitted with a drop in lid. The size is not of course critical, though the dimensions shown in figure 3 are about right. The loudspeaker is mounted on the lid and the whole lot glued using Araldite or some similar adhesive. The siting of the on-off switch and VR1 can be seen from the drawings and the photographs. A solder tag should be fitted to the chassis to provide the common negative point; this is best fitted on the screw holding the battery clamp which can be cut out from some scrap aluminium of thin gauge.

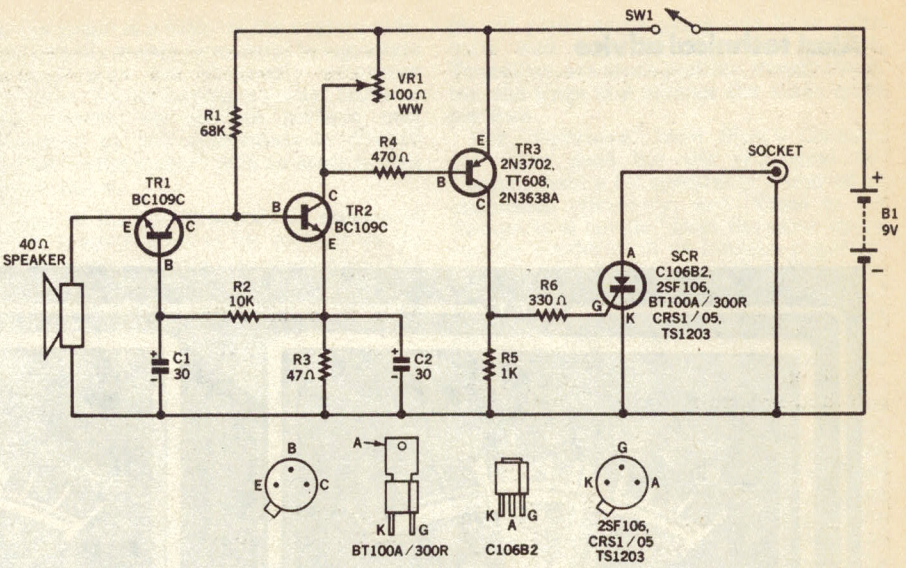



*Figure 1: The circuit of the flash trigger unit. Tr1, Tr2 and Tr3 form an amplifier which triggers the SCR in response to a sound.*

The top of the chassis can be fitted with a photographic accessory clamp; these are available from photographic suppliers. They are provided with very small screws without nuts and the simplest way of fitting this is to drill two very small holes and self-tap the screws into these.

I have found that the 3mm. co-ax sockets which are used for flash fittings are rather hard to buy; if these are available or can be purchased one could be fitted to the chassis as the output socket. The author used an extension lead fitted with both male and female sockets. One end was cut off and the loose wires soldered inside the chassis. The connector then runs out through a hole, providing a longish lead to which to connect the flash gun lead. This can be seen from the photograph.

A calibrated knob should be used for VR1. Note that VR1 must be a wire wound type; the original use of a carbon track type was a failure and the positive action of a wire wound type is much preferable.

The uses of such a device are many and varied. The action of operation is extremely rapid and the slight delay from the making of the sound to the actual flash is not electronic but solely due to the time taken for the sound waves to reach the unit. The closer the unit to the sound source, the less the delay.

Those who are experts in photography will not need any advice on how to use this device but for those with less expertise, operation should be a follows.

All subjects should be photographed in subdued light — the darker the better. The flash gun should be charged up and a dummy run made, if this is practical, this will ensure that the sensitivity control is correctly set. If a dummy run is not practical it should be possible to estimate the approximate loudness of the sound that will be produced and the hands can be clapped to provide a sound of roughly equal loudness. Normal movement and conversation are quite possible without any danger of the flash being accidently triggered except on the most sensitive settings.

When all is ready the flash gun should be charged, the shutter of the camera opened, the sound made and the shutter closed. Obviously the shorter the shutter remains open the better.

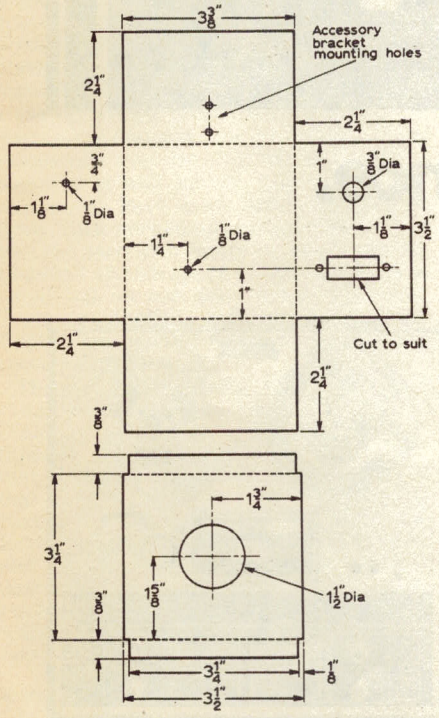
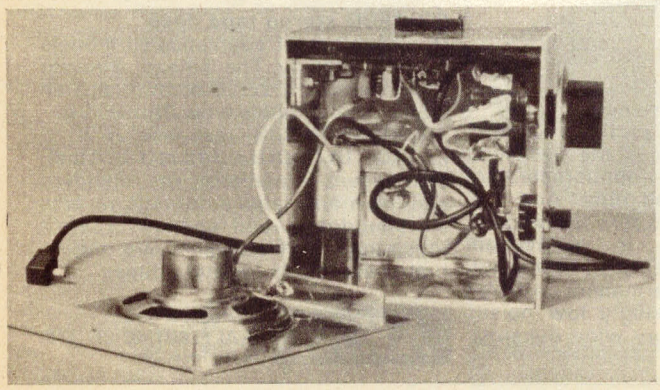
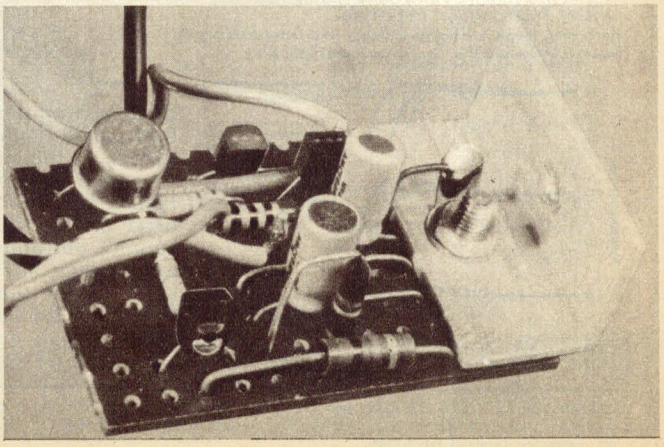
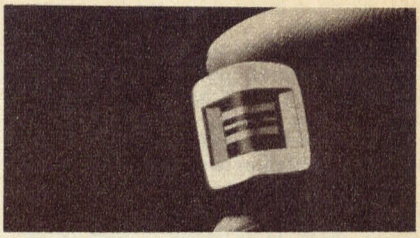


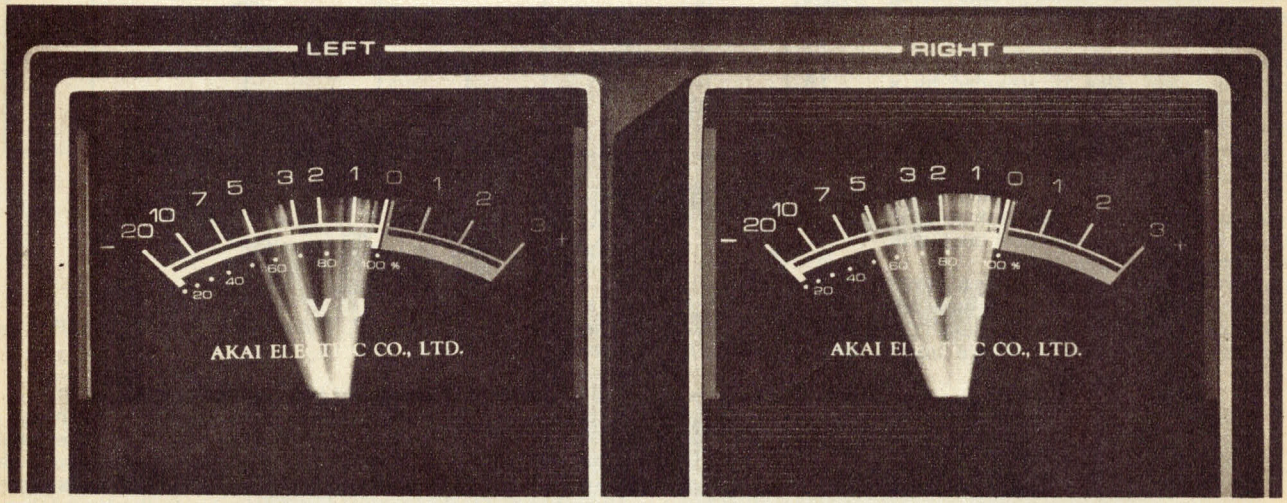

*Figure 3: The metalwork details.*





*Above and at right are views of the interior of the unit and the wiring board.*



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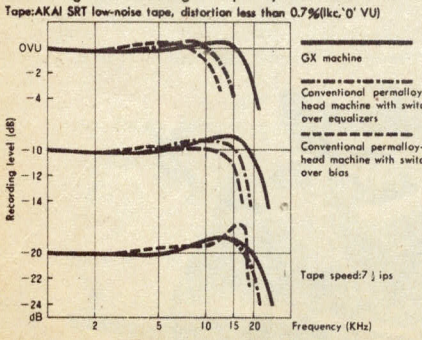


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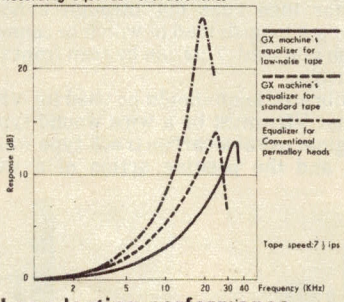


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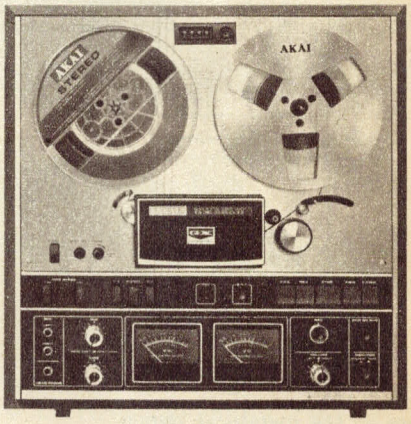


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# A horn-loaded loudspeaker system

Horn-loaded loudspeaker systems are at present not as popular as sealed or reflex systems, but there is no doubt that they will always have dedicated adherents. The author of this article is very enthusiastic about the system he has developed, which is the product of many years of experiment. While not necessarily agreeing with all of his design philosophy, we present the article for the benefit of those who would like to try out this type of system.

by MALCOLM D. McLEOD*

A good loudspeaker system requires the least imagination on the part of the listener. In this article, it is intended to show the main problems and deficiencies of loudspeakers, and details will be given which if closely followed will give superb results.

The requirements in order of importance are:

a. Low distortion.
b. Freedom from serious peaks and dips in the frequency response.
c. Reasonably wide frequency response.

Let us look at the mechanics of a cone loudspeaker. The paper cone is driven at its apex by a voice coil, and in turn the cone drives the air, i.e., if instantaneously the cone moves forward, the pressure at the front is high and at the back it is low.

As the cone is not absolutely rigid, it does not exactly follow the driving force from the voice coil over the whole surface of the cone, and furthermore resonances within the cone are excited over its whole surface.

The result is that much of the energy now supplied to the air is in the form of frequency components which were not supplied by the voice coil.

This is most severe on transients, and leads to "edgy" reproduction. Let us delve a little deeper. The paper cone of a loudspeaker has a high mechanical impedance, i.e., press it with your fingers — it is relatively hard to push. Now the air it is trying to couple to, has a low mechanical impedance, i.e., it is easy to push. The result is that they are sadly mismatched to each other. If we were to introduce an acoustic impedance transformer to match the high impedance of the speaker cone to the low impedance of the air, we would receive many benefits.

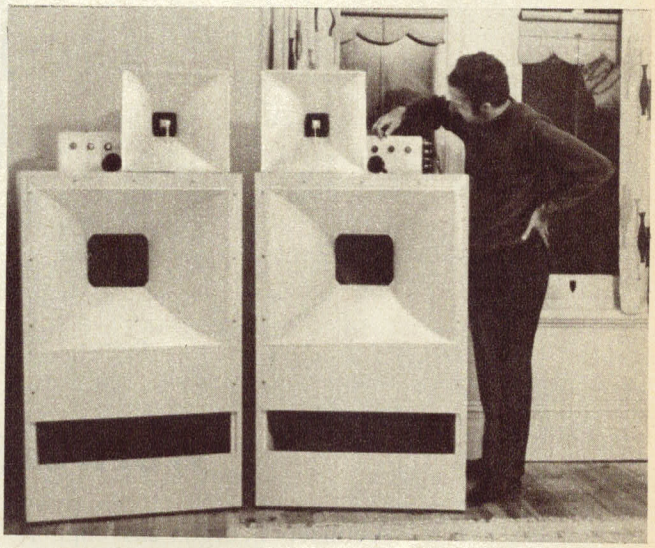
1. A great improvement in the efficiency of converting the electrical signal in the voice coil to acoustic output.
2. By matching the cone more accurately to the air, i.e., presenting the cone with a high mechanical impedance load, the development of spurious resonances over the surface of the cone will be discouraged, and much cleaner reproduction will result.
3. A further gain which will result is that due to the overall increase in efficiency, less input is now required for the same acoustic output, resulting in a further reduction of distortion.

* 204 Wattle Street, Malvern, SA.

A correctly designed exponential horn is a mechanical impedance transformer.

As most of the information we hear, and of which we are the most critical, occurs in the mid-range, this is where we should start. Therefore the problem is to design a mid-range horn which must have no "character" of its own. It must be completely neutral.

Looking at the overall requirements, 400Hz has been chosen as the most suitable crossover point from the bass speaker. The mid-range horn has therefore been designed for a mouth cut-off of 300Hz which allows ample overlap.



*The author shown with two of the loudspeaker systems described in this article. The treble units and crossover networks are alongside the mid-range horns on the top of the bass enclosures.*

A total of 21 different mid-range horns were built, the one to be described giving subjectively the best results. It can be truly stated that this unit is quite uncoloured and very clean on all types of program.

Having chosen this as the best design, a duplicate was made, and arranged to switch from one to the other. In this way, one could be compared with the other using different speakers as drivers.

Being connected with the trade, dozens of types of speakers were available for test, and the final choice is a Rola C64G oval speaker. The fact that this is a very inexpensive speaker is irrelevant. It has been chosen on its merits.

One problem was that the high frequency range of the speaker became restricted when put in the horn, and on listening tests left a gap between the top of the mid-range horn and the bottom range of the treble unit.

As this appeared to be a cancellation problem in the throat of the horn at high frequencies, a series of phasing plugs were tried in the throat and compared with the other horn.

With the phasing plug shown, the problem was entirely cleared.

Frequency response measurements made on this horn show fairly bumpy results — nothing to indicate why it sounds musically so much better and cleaner than a variety of mid-range direct radiators, some of these units giving a smoother frequency response.

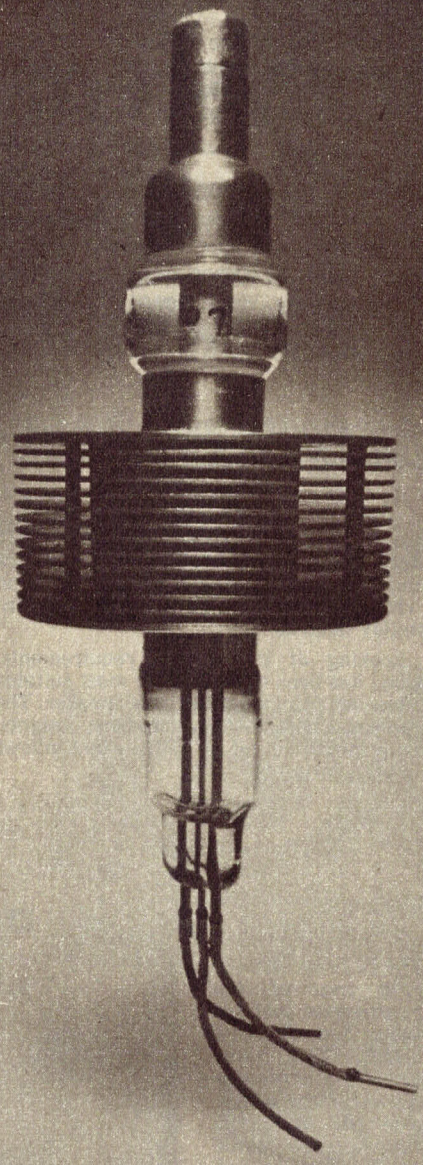
After months of listening, I can only conclude that of all the qualities we can talk about regarding loudspeakers, frequency response is NOT the most important.

It becomes increasingly obvious that a low distortion is the first requirement, and while difficult to prove this point scientifically, the audible improvement with the horn is obvious.

What came as a quite unexpected side effect was a very noticeable reduction in the intensity of clicks and plops from the surface of discs. This helps to support the theory that the increase in the mechanical impedance of the air load offered to the cone by the horn, discourages spurious cone resonances.

Construction of the horn and rear compression chamber is from 3/8" flakeboard. A sheet 6' x 3' will make a pair. Opposite sides of the horn are identical. From pattern A, make a cardboard template. When put on the flakeboard and a pencil run around the template, this will give half a top. The template must now be turned over so that the same edge lines up with the line along x-x, and the pencil run around again.

Repeat this operation three times for two



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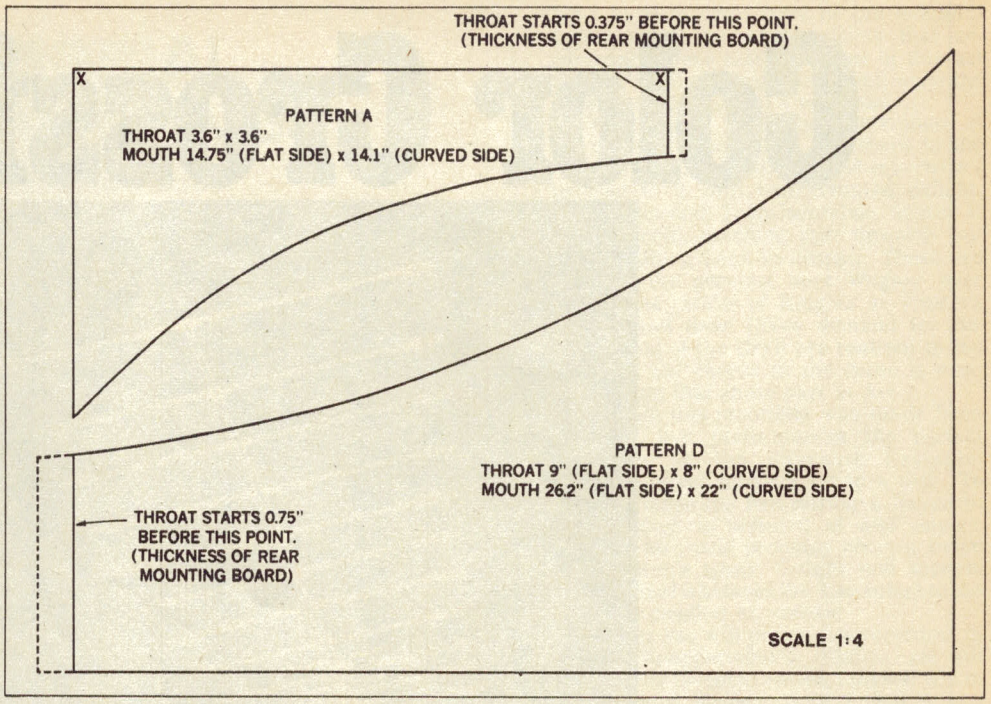



*Templates for the mid-range and bass horns. Both are for only half of a top or bottom, and must be turned over to produce the full outline. They are reproduced here one-quarter actual size. Pattern A is for the mid-range horn, and pattern D for the bass unit.*

tops and two bottoms. Cut two pieces according to pattern B. These are the rear mounting boards.

Top and bottom and rear mounting board are glued together as in figure 1. A pair of nails driven into the bench top each side of the top and bottom will locate them while the glue dries. These locating nails must be placed so that the internal space between the top and bottom is 14.1".

It will be necessary to adjust the angle of mating surfaces at points M.

When dry, the sides can be built up. These curve all the way and are made from strips of the same material cut 1" wide and glued and bradded. The angles of adjoining surfaces should be adjusted to fit each other and each face should be flooded with Aquadhere cement and pressed together and a brad driven in each end.

When completed and dried, use a coarse sandpaper to round the curved sides of the inside of the horn. All cracks should then be filled with "Agnews" water putty, which when cut back will give a smooth surface ready for finishing.

Build the box onto the rear mounting plate with internal measurements of 8¼" x 8¼" x 3". A removable back is screwed onto the back of the box and lined with 1" absorbent. The speaker is mounted with the long dimension vertical.

The phasing plug which is of square section, is made to pattern C and centrally mounted with about ⅛" clearance from the centre of the loudspeaker cone. The wide end of the phasing plug is nearest the cone.

All surfaces should be undercoated before finishing coats are applied.

Construction of the bass horn is the same in principle as the mid-range horn, this time using pattern D.

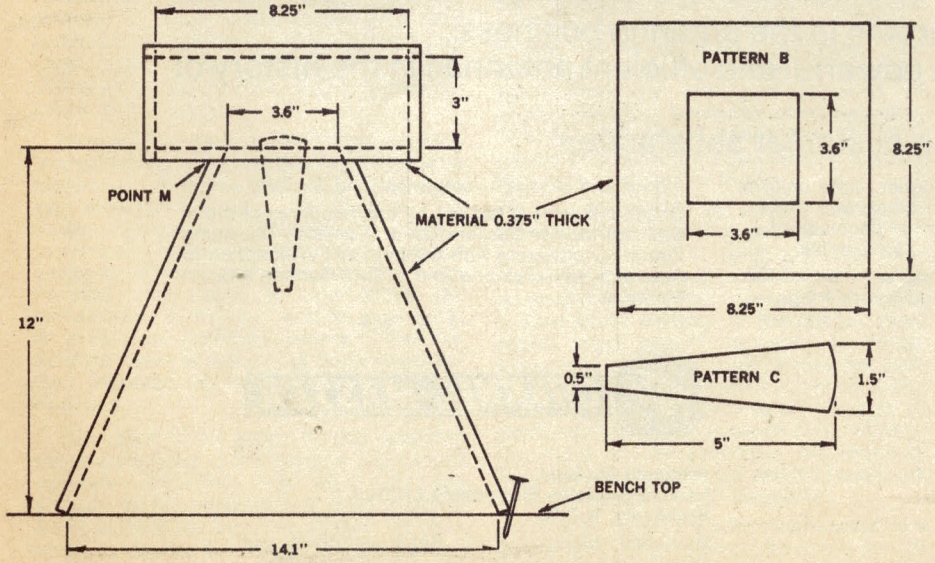
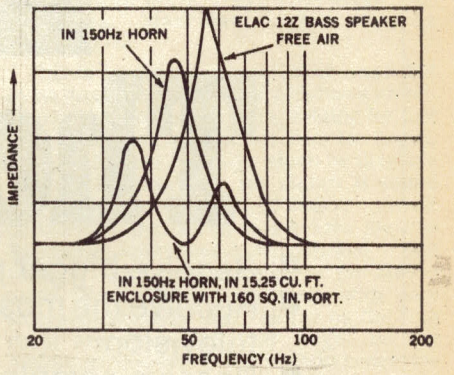



*Figure 1: Dimensions of the various parts used to make up the mid-range horns. The diagram on the left is in effect a vertical cross-section through the horn. Pattern "C" is for the HF phasing plug.*

The diagrams give all measurements for construction of the main cabinet. Three quarter inch flakeboard is used for both the horn and cabinet. All parts of the cabinet are glued and nailed together, the only removable part being the horn itself. The part which is 6" x 28½" is left open. All internal surfaces must be lined with 1 inch absorbent such as bonded acetate fibre.

The internal volume of the cabinet is about 15 cu.ft. This is necessary to obtain high efficiency in the low bass range in keeping with the high efficiency of the upper bass range due to the horn loading.




*Curves illustrating the effect of the bass horn and enclosure, using a fairly typical 12-inch speaker unit.*

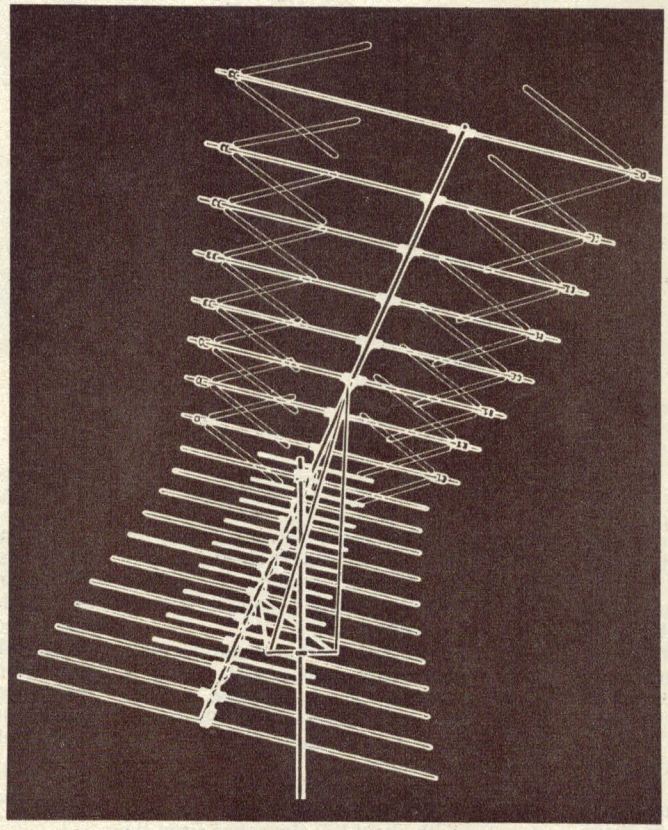
Sweeping down from 400Hz with a signal generator, the response is smooth, and full efficiency is maintained to 32Hz, below which frequency doubling starts.

No internal bracing is required. The shape of the cabinet gives ample strength. Furthermore, instantaneous pressures are not high due to the large cabinet volume.

Do not attempt to simplify construction by making the back of the cabinet straight. This is a refinement on an earlier model to reduce the average depth front to back and improve tuning.

There is no tendency at all for male voices

# Color Crossfire



# The Receiver

- Receive bigger profits in the antenna business
- Receive the most powerful and efficient antennas in the history of television
- Receive complete customer satisfaction

Patented Color Crossfires have higher, more uniform gain over all channels—fantastic black and white improvement—and ready to meet the demands of colour—13 different models, 7 to 28 elements.

Channel Master supplies everything but the roof for every type of installation—metropolitan to fringe—indoor and outdoor—single set and MATV.

Channel Master is backed by the resources of the Channel Master Corporation of America—the name that is synonymous with the best in TV reception in Australia, New Zealand, the U.S.A., Canada and Malaysia.

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**Brookvale, N.S.W.**

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HSE7347/272

to be boomy. At the same time, when there is low frequency energy in the program results are smooth and full. I cannot imagine any conditions ever needing bass boost. If the condition did arise I would suspect the amplifier or pickup. Wonderful definition is heard in the bass instruments on good records — alas, not all records are good.

Regarding bass speakers, most suitable types will have resonances between 45 and 60Hz as a generalisation.

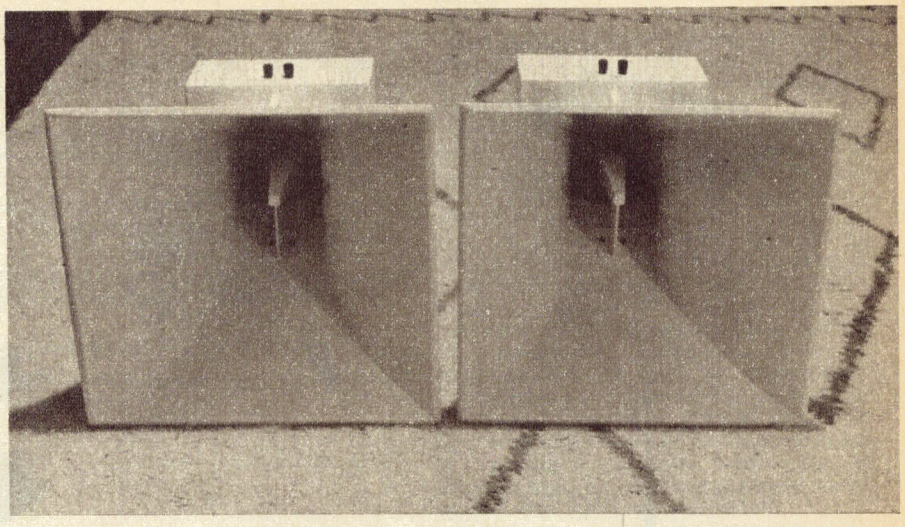
The long throw, very low resonance types are quite unsuitable.

Best results in order of preference were from the following types. They are all 12 inch units. Elac 12z, MSP 12UA, Rola 12PEG or 12PX. However, these are only mentioned as a guide. Other types may be found equally suitable.

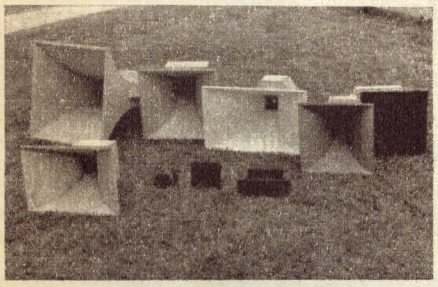
Many high frequency horns were tried, and in my opinion the Goodmans Trebax 100 is the most suitable. It is interesting to note that this same unit can sound completely foreign in a direct radiator system. In this all horn system the overall blend is very good.

Crossover between each speaker is at 400Hz and 5000Hz and the slope rate is 12 dB / octave.

All capacitors in the crossover network must be non polarised, with preference for paper dielectric. Good non-polarised electrolytic capacitors may be used for C1, but not for C2. This item should be paper or plastic dielectric. The use of back to back electrolytic capacitors is not recommended.



*A picture of the prototype mid-range horns, to indicate how the reader's horns should appear when completed. Note the HF phasing plugs.*



*A selection of horns made by the author during the evolution of the design described on these pages.*

All coils are air wound on formers made from 1 inch broomstick with masonite or plywood ends. Dimensions must not be changed and wire should be 18 B and S enamel or a little heavier if on hand.

Glue the cheeks to the 1 inch dowel and secure with a brass screw.

Normal steel screws must not be used. Layout is not critical but coils should be spaced by not less than 3 inches.

As the high frequency range of the mid-range horn does not extend beyond 5KHz, no restriction on the HF range is necessary in the crossover network.

The values of L1, C1, L2 and C2 are selected from the chart according to your choice of 8 or 15 ohm speakers.

In case of the use of a Trebax 100 HF horn which is only available in 15 ohms, it is quite in order to place a 16 ohm resistor in parallel with it and treat it as being 8 ohms from the point of view of crossover design and bearing in mind that this has reduced its sensitivity by approximately 3dB.

In the crossover circuit, 3 resistors appear in the mid-range circuit and the same in the treble circuit.

These form an attenuator of constant resistance, and from the chart the appropriate resistor values are chosen for the degree of attenuation required at the impedance you have used.

Although exact values of resistors are

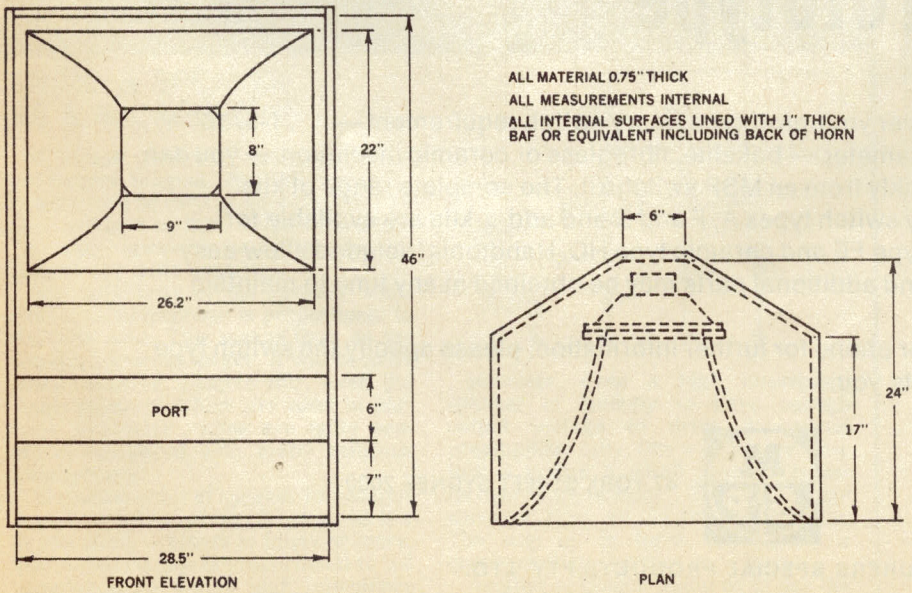
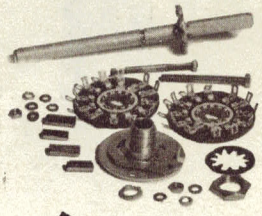
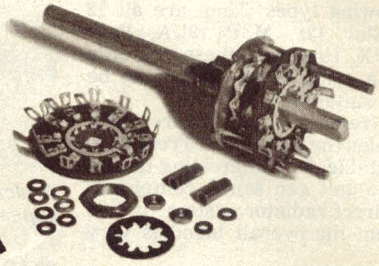
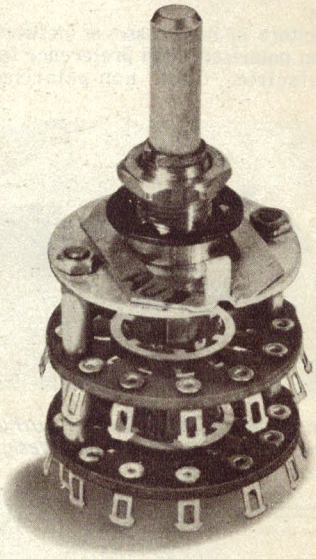



*Figure 2: Details of the bass enclosure, which uses horn loading down to 150Hz, and becomes a reflex system below this frequency. Note the "chamfered" cabinet back, important for its tuning.*







# the fifteen minute prototype

Whatever your prototype rotary switch requirement — 1", 1-5/16" or 1-7/8" diameter — bakelite, fibreglass or ceramic insulation — you can make it quickly from an MSP switch kit. The complete range of kits cover rotary switch types A, F and H and add-a-kits are available for fibreglass type FE and ceramic type HC. Handtools included allow easy assembly and additional parts may be obtained at any time to maintain kits.

Write or phone for further information, please specify the switch type that interests you.

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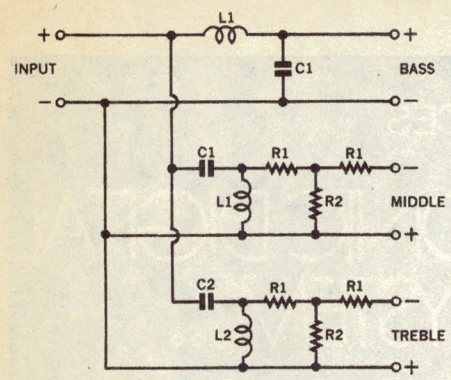
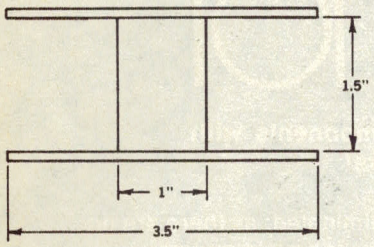
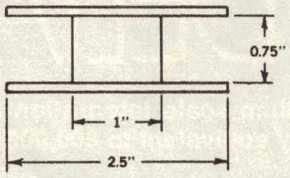



| | 8 OHM | 15 OHM |
|---|---|---|
| L1 | 4.3mH | 8.5mH |
| L2 | 0.36mH | 0.67mH |
| C1 | 32μF | 16μF |
| C2 | 3μF | 1.5μF |

| ATTENUATOR RESISTORS | | | | |
|---|---|---|---|---|
| dB ↓ | 8 OHM SYSTEM | | 15 OHM SYSTEM | |
| | R1 | R2 | R1 | R2 |
| 2 | 0.92 | 34.4 | 1.73 | 64.5 |
| 4 | 1.8 | 16.8 | 3.4 | 31.5 |
| 6 | 2.6 | 10.7 | 5 | 20 |
| 8 | 3.5 | 7.5 | 6.5 | 14.2 |
| 10 | 4.2 | 5.6 | 7.8 | 11 |
| ALL VALUES IN OHMS | | | | |




4.3mH = 460 TURNS 8.5mH = 600 TURNS




0.36mH = 120 TURNS 0.67mH = 160 TURNS
18 B & S ENAMELLED WIRE FOR ALL COILS

*Figure 3: Details of the crossover network for the system, including resistor values for the equalising attenuators.*

shown, it is not implied that this degree of accuracy is required. Ten percent variations are quite permissible. Many of the values will not be available as such and will need to be made up from combinations. Use resistors of 1 watt rating or higher.

Regarding values of capacitors C1 and C2, 20 percent tolerance is in order.

In the case of the prototype, 6dB attenuation is used on the mid-range and 4dB on the treble.

However if your bass speaker is of a different sensitivity, the attenuation of the mid-range and treble will need to be altered.

Room absorption can have a marked effect so only regard the suggested attenuation figures as a guide.

As a further guide, assume you are building an all 8 ohm system. You will be making 4 coils of 4-3mH and 2 coils of .36mH.

Using 18 Band S enamel wire, you will need approximately 6 lbs.

When connecting speakers to the crossover network observe the polarities.

It will be noticed on the crossover circuit the opposite connections to the bass speaker compared to the mid-range and treble. Due to phase shift in the crossover network this is necessary so that they are acoustically in phase at the crossover point.

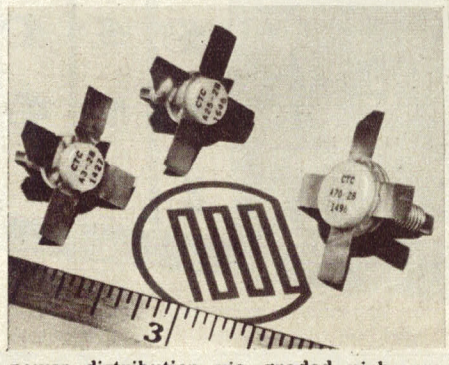
# Transistors give 140W at 80MHz

Communications Transistor Corporation, an affiliate of Eimac / Varian in San Carlos, California, has announced a complement of three rugged communications transistors capable of delivering 140 watts at frequencies up to 80MHz.

Operating from 28 volts and covering the frequency range of 30 to 80 MHz, the devices forming the CTC complement are the 3 watt A3-28, the 25 watt A25-28, and the 70 watt A70-28. When used in a chain consisting of one 3 watt, one 25 watt, and two 70 watt devices, a 140 watt output is achieved from an 0.2 watt input.

All three devices are 100% tested and are guaranteed to withstand infinite VSWR at all phase angles when operated at 80 MHz, 28 volts rated power.

Other features include reliable passivated single chip construction, greater high frequency performance in low inductance hermetic stripline packages, and optimized



power distribution via graded nichrome resistors.

Prices in the US for quantities of 1 to 99 are: A3-28, $8.15; A25-28, $24.10; and A70-28, $65.00. CTC also have a 28V transistor capable of 1W RF output at 960MHz.

Australian agents for CTC are Varian Pty Ltd, of 38 Oxley Street, Crows Nest NSW, and 679 Springvale Road, North Springvale, Vic. Enquiries for the above devices may be directed to this firm.

# FORUM

Conducted by Neville Williams

## *Curses . . . . they've done the impossible!*

"The difficult we do immediately. The impossible takes a little longer." So runs the old slogan, which nobody ever took seriously. But it seems to have happened to us and left us with a slightly pink face. Pink, I said, not red!

The situation to which I refer had its beginning when we received a request from a reader which was summarised thus, for publication in the January issue:

**ECHO UNIT:** I have been searching for circuit diagrams of an echo unit other than a spring delay-line type, a reverberation plate or a tape unit. I require a type that possesses a variable delay time with a natural echo that I can use in conjunction with a PA system and other musical systems. (M.H., Brisbane, Qld.)

We've been receiving letters like this quite regularly for the past ten years at least. Most frequently they have come from electronic organ enthusiasts who have realised that such an instrument, played in a largely echo-less lounge room, needs some artifical reverberation to make the sound more satisfying and more like it would be if the same instrument were being played in an auditorium.

To be satisfactory for this purpose, the artificial reverberation needs to be quite diffused and to persist over one to two seconds. Methods which have been attempted or exploited include the following:

1. Diverting part of the organ output to a loudspeaker in a cellar or a large buried stormwater pipe, then picking up the sound, plus echoes with a microphone which feeds a second amplifier in the listening room.
2. Using a horn driver loudspeaker to feed sound down a long coiled length of plastic hose pipe, with a microphone at the other end to pick up the sound after it has travelled down the pipe.
3. Diverting some of the signal from the organ to a transducer which vibrates a large, free-hanging metal plate. A contact microphone attached to the plate picks up the sound energy after it has traversed the plate, along with random residual vibrations.
4. Feeding the energy into coiled springs, picking it up again at the far end of the springs with a suitable transducer.
5. Recording the original sound on a loop of tape then picking it up again with a series of playback heads. This produces a series of artificial echoes, delayed in time according to the speed of the tape and the distance between the heads.

The spring reverberation unit is the one which has proved most practical for standard electronic organs, guitar systems, and such like.

The level of the signal fed to the springs, and the frequency response of the input and output amplifier chain has to be chosen very carefully, however, if the system is to work well. With too much level or too much bass fed into the springs the reverberated output will suffer from cross-modulation. On the other hand, too little input and too much gain after the springs will cause them to produce shattering noises when bumped.

Get everything just right and they can give extremely good results.

But, of course, springs, plates, chambers, tubes and tape systems are mechanical in operation and "primitive" in the mind of electronically oriented people. Hence the frequent questions about achieving the desired results by purely electronic means.

Over and over again through the years we have had to make the point that, for all practical purposes, it could not be done. It has just not been practical to delay signals for a second or more in electronic circuits — unless you're prepared to think in terms of a transcontinental telephone line, or something of that nature. So we've got used to saying "it's not possible".

That's what happened towards the end of last year, for the umpteenth time. Faced with the letter mentioned above, one of our staff dashed off the answer which appeared in the January issue. All this would probably have happened sometime during November. The answer read as follows:

There appears to be a popular misconception among a section of our readers, namely that it is possible to produce an audio echo effect by purely electronic means. Unfortunately, we know of no way in which this can be done and, while it might be presumptuous for us to say that it cannot be done, we will go so far as to say that it is impractical at the present state of the art. What's more, we would suggest that anyone who can come up with a practical solution will make a lot of money. In the meantime, M.H., we are afraid you are going to have to settle for one of the systems you have nominated, or go without, for we know of nothing else.

Editor Jim Rowe noticed the par in the final page proof; he had some reservations for reasons that will become apparent in a moment but decided that it was near enough to the truth to let it go. Once material gets into made-up page form, close to printing deadline, fairly powerful motivation is required to induce an editor to tear it to pieces!

But a couple of readers were free from such inhibitions. The more outspoken of the two has this to say:

*Dear Sir,*

*In your columns of the January 1971 issue of "Electronics Australia" you had a query about an echo system. Your reply, I feel, was made from an uninformed viewpoint.*

*There has been on the Australian market for several months an electronic echo generator. It uses analog to digital conversion, digital delay up to 320 milliseconds, then digital to analog reconversion (See "Australasian Electronics Engineering", November 1971.)*

*Your magazine obviously is one of the main links between the industry and the public in Australia and I feel that you have a responsibility not to perpetuate obsolete ideas.*

*G.G. (South Yarra, Vic.)*

Superficially, it looks like a real red-face situation. But, before we become too ruddy of countenance, let's have a closer look at the actual device in question.

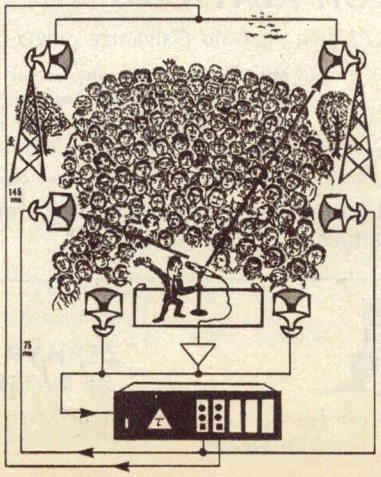
We assume that our correspondent is referring to the unit advertised on page 30 of the issue of the aforesaid journal, and advertised by Simon Gray Pty Ltd.

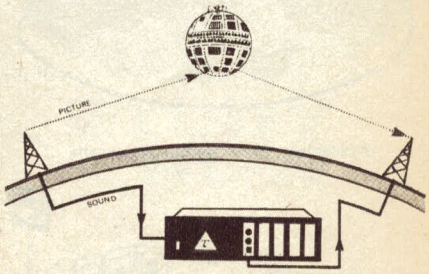
To give it its full name, it is the Gotham Delta-T 101 Audio Delay System. It operates in the manner which our correspondent describes and does indeed produce a significant audio delay. What is more, the specifications make beautiful reading to anyone who has had to put up with the problems of electro-acoustic delay devices:

Response, 20Hz to 12KHz, plus and minus 2dB; harmonic distortion, less than 1%; input signal dynamic range, 60dB; wow and flutter 0%

You little beauty, but . . . . .

The least expensive model sells wholesale (including duty) for $5,154. For that you get a single echo which can be delayed in time






*Reproduced from the manufacturer's brochure, these are the kind of jobs for which the Delta-T Audio Delay System is best suited. At left it is being used to delay the signal fed to the more distant loudspeakers so that the audience hears the sound from all sources at the same instant.*

NEW!

# LPS INSTANT COLD GALVANIZE . . .

## equals hot-dip galvanizing at 1/2 the cost


Available in 16 oz. Aerosol spray-cans

LPS Instant Cold Galvanize is a ready to use 95 p.c. PURE ZINC compound that provides long-lasting protection from rust and corrosion.

LPS Instant Cold Galvanize is NOT A PAINT! When applied to iron or steel it generates a positive electric current that flows to the base metal. This electrochemical action fuses the zinc compound with the metal. Corrosion will attack only the outer zinc coating leaving the metal to be protected rust free. If coating is penetrated LPS Instant Cold Galvanize will sacrifice itself to protect the exposed base metal. RUST CANNOT SPREAD.

## USES:

LPS Instant Cold Galvanize should be used wherever metal is exposed to corrosive conditions such as in the construction and maintenance of:

| | | |
|---|---|---|
| AUTO & TRUCK BODIES | RAILROADS | TRAILERS |
| FARMING EQUIPMENT | WATER TANKS | FENCING |
| MARINE EQUIPMENT | MOTOR BIKES | OIL RIGS & PIPE LINES |
| METAL ROOFS & FLOORS | TV AERIALS | STRUCTURAL STEEL |
| MINING EQUIPMENT | SNOWMOBILES | LINES & TOWERS |
| OFF-SHORE STRUCTURES | GOLF CARTS | UNDERGROUND EQUIPMENT |
| POWER PLANTS | PATIO FURNITURE | LAWN & GARDEN EQUIPMENT |

AIR CONDITIONING, HEATING, & REFRIGERATION SYSTEMS

## TECHNICAL INFORMATION:

Passes PREECE TEST for hot-dip galvanizing
SINGLE APPLICATION THICKNESS – approximately 1½ mils
COVERAGE – approximately 50 square feet per pound

TOUCH DRY – 1 minute . . . can be painted over in 6 hours or 30 minutes after baking at 350° for 15 minutes

WITHSTANDS:

- Over 3,000 hours in salt spray cabinet
- Water temperature above boiling point
- Continuous dry heat up to 750° F.
- Short period heat up to 1000° F.

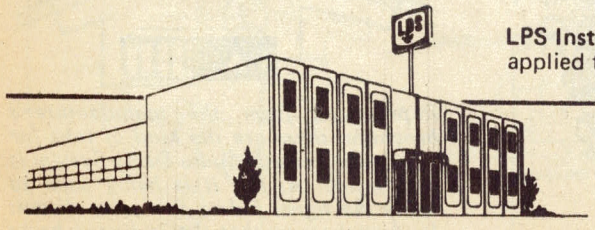
## SPECIFICATIONS:

LPS Instant Cold Galvanize meets or exceeds the following specifications:

MIL - P - 46105 weld thru primer
MIL - P - 21035 Galvanizing repair ( U.S. Navy )
MIL - P - 26915A for steel ( U.S. Air Force )
MIL - T - 26433 for towers ( Temperate and Arctic Zones ) ( U.S. Air Force )

Complies with Rule 66-3 Los Angeles and San Francisco

**LPS Instant Cold Galvanize** provides maximum protection when applied to clean, dry metal.



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up to a maximum of 40 milliseconds.

Undoubtedly there would be some professional and/or specialised applications where a precise 40mS echo would be worth every bit of $5,154. If it were otherwise, the companies concerned would hardly have gone to the trouble of developing and marketing a device of that nature.

But for the production of electronic music, as from an organ or guitar, it would be an awful lot of dollars to pay for a tiny bit of echo. As we mentioned earlier, synthetic echoes for that purpose need to be so numerous that they blend into a smooth reverberation effect, and they need to extend over a couple of seconds, if required.

To be sure, you can get a Delta-T unit with a longer delay but the price has climbed to $11,801 by the time the delay has reached a maximum of 320mS. I gather that it is possible to extract up to 5 outputs, but each extra output involves several hundred dollars for the requisite extraction circuitry!

If you happen to own a recording studio and you want to transfer your artists acoustically into the City Hall, the Delta-T unit would be nice to have around.

Or, if you're wiring the City Hall with a multiple loudspeaker system and want to introduce a progressive delay towards the rear of the auditorium, a Delta-T would make it very easy to arrange.

But, best of all, if you own a satelllite system and want to delay cable-borne sound to coincide with the satellite-borne picture, $12,000 odd for a maintenance-free electronic delay system would be a mere detail!

On the other hand, to hang on to an domestic electronic organ, $12,000 worth is a bit much for a reverberation system!

Can one buy or build an all-electronic unit more appropriate to the task, with a diffused and sustained output, and selling at, say, $200?

No you can't. If that's what you need and that's the kind of money you are prepared to pay, you may as well settle for a spring system and forget about the all-electronic approach for the foreseeable future.

But even though it's still not possible "at the present state of the art" to build or buy a practical unit for the role envisaged, we must agree to modify the stock answer we have been giving all these years.

The manufacturers of the Delta-T unit claim that, in its most developed form, their Audio Delay System utilises the equivalent of 600,000 transistor functions. The question is how long it will take to enlarge the time delay and signal content of its output while, at the same time, rationalising circuitry on this scale to the point where it can be marketed for one-twentieth the price or less.

Anyone who manages to do this may very well "make a lot of money".

*Gentlemen:*

*The ELECTRO MUSIC Department of Columbia Broadcasting System Inc., is the owner of the well-known trademark LESLIE. I call your attention to Australian registration number B208, 357.*

*The September 1971 issue of "Electronics Australia", in an article starting on page 36, refers to "so-called Leslie systems" and "conventional Leslie".*

*Will you please note and permit your readers to note*

*(1) LESLIE is a registered trademark owned by Columbia Broadcasting System, Inc.;*
*(2) LESLIE denotes a brand of goods — goods emanating from a particular source of origin;*
*(3) There is no such thing as "so-called Leslie systems" or "Conventional Leslie". The proper terminology would be effects or sound produced by rotary sound channels;*
*(4) The trademark LESLIE is properly used only thus:*

*LESLIE SPEAKER SYSTEMS; or*
*LESLIE DEALERS; or*
*THE LESLIE TRADEMARK. .*

*For your information, LESLIE is also a trademark for organ accessories other than speaker systems.*

*Very truly yours,*

*Paul T. Kramer*
*Export Sales Manager*
*ELECTRO MUSIC*

# The Tucker Tin Mark 2*

## An SSB Transmitter of simple design — Part 3

Here is the third and final article describing the author's easily-built solid state SSB transmitter. He gives full details of the setting up and alignment procedures, and also details of the modification required to adapt the rig for AM operation.

**by FRED JOHNSON, ZL2AMJ**

Head, Department of Electronic Engineering,
Central Institute of Technology, Petone, New Zealand

Getting the rig to perform involves two main steps which I am calling "setting up" and "alignment". The "setting up" phase involves checking the rig thoroughly for general operation. When this is concluded the "alignment" stage involves adjusting the various preset controls for optimum suppression of the unwanted sideband.

Before either step can be undertaken, it is important to discuss the test equipment that you should have available. You need several essential items. These are all useful in the shack for other tasks so are a separate wise investment. You will have to construct three simple items of test equipment — a wavemeter, an audio oscillator and a dummy load. A multimeter and a receiver are two other items that are necessary. The only other item you could find useful is an oscilloscope. This is not an essential item but there is no doubt that it is of great assistance. Two alignment methods will be described later — one that uses the oscilloscope and one that uses a receiver.

A simple absorption wavemeter is shown in figures 15 and 16. This should cover 3.5 to 3.9 MHz for checking on the mixer and PA stages, 5 to 5.5 MHz for checking the VFO, and 9 MHz for checking the crystal oscillator and balanced modulator sections. By making the wavemeter cover 3.5 to 9.0 MHz in one sweep of its tuning capacitor all these tasks can be easily done. This is another task where a printed-circuit board can be used to advantage to provide the mounting baseboard and also the interconnecting wiring as well as a panel.

The photograph shows how my unit evolved. Any meter scale can be used. There is nothing critical about this construction. Calibration can be arranged using a signal generator, grid-dip oscillator, or some similar signal source that covers 3.5 to 9 MHz. Even the local oscillator of an all-wave receiver could be used to provide the calibration signal, provided you make the necessary correction (knowing its intermediate frequency) to relate the signal frequency indicated on the receiver dial to its local oscillator frequency.

Other types of meter, diode, coil and construction could be used.

Figures 17 and 18 show an audio oscillator circuit using a field-effect transistor. This circuit provides a 1000 Hz sinusoidal signal which is suitable for use as a tone for alignment of phasing-type SSB rigs. The requirement is for a 1000 Hz tone with very little harmonic content. I have been unable to achieve adequate signal purity from a simple R-C type transistor oscillator, so have resorted to using a tuned circuit.

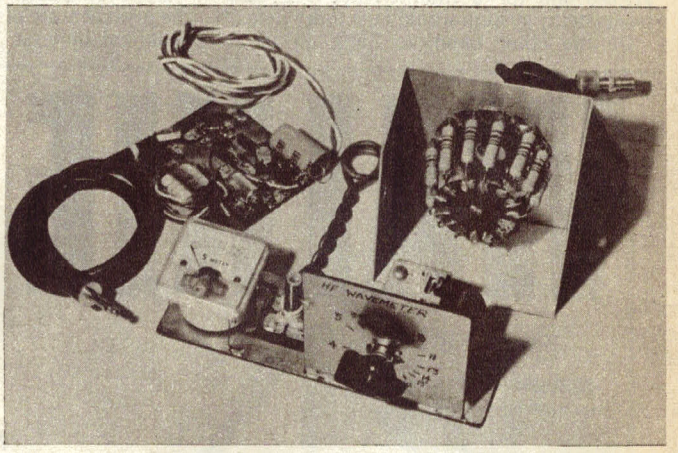
The output signal level must be comparable to the output from a microphone. Too much output is undesirable otherwise overloading (hence distortion) in the audio preamplifer (i.e., before the gain control) can occur. The voltage divider (gate-leak resistor) feeding the oscillator output can be modified (by changing the value of the lower resistor) to alter the output level if required.

This is another unit that is useful to have in the shack for other tasks.

A dummy load is essential when carrying out tests and adjustments to any transmitter. A very simple load for this rig can be made by connecting seven one-watt 470 ohm CARBON resistors in parallel. This gives an effective load of about 67 ohms. These can be mounted on a coaxial lead with a plug that fits into the antenna socket on the rig. Any resulting load between 50 and 80 ohms and rated at 5 watts or more is satisfactory. Avoid wire-wound resistors (which may be inductive). I used fourteen 1000 ohm 1 watt carbon resistors in parallel and connected to a coaxial socket. This load was constructed many years ago and has been used with many transmitters.

The first stage in setting up the rig is the debugging that is necessary before alignment can proceed. The aim is to get each stage operating successfully with a signal path from the microphone right through to the antenna. When all circuits are functioning satisfactorily, then the adjustment of the circuits that establish the sideband suppression can be attempted.

When all wiring up has been completed, and your rig looks tidier than the prototype and before switching on, please do one thing — sit down, take your time, and go over the complete circuit and rig, wire by wire, component by component. You will be surprised what you may find. In particular, look at the polarity of all electrolytic capacitors, the types and positioning of all transistors, and the connections to all transistors. Time spent doing this is time well spent.




*The test tone oscillator, wavemeter and dummy load built up by the author for testing the original Tucker Tin rig.*

Test conditions at points throughout the prototype rig are shown in Table 2, to assist with any possible troubleshooting. All measurements are made with a 1 kHz tone fed into the microphone socket, and with a 75 ohm RF wattmeter acting as a dummy load, Audio gain fully "on", and with rig tuned up on 3.7 MHz.

All voltmeter readings are made with a 20,000 ohm per volt multimeter.

Oscilloscope readings are peak-to-peak. These readings can be changed to a peak reading by dividing the values quoted by 2, or converted to RMS by dividing the value quoted by 2 and then multiplying by 0.707 (this latter should be the value read from a peak-sensing RMS — indicating VTVM with RF probe).

Oscilloscope measurements are made

*This article is reprinted from the August 1971 issue of "Break-In", the official journal of the New Zealand Association of Radio Transmitters Inc., by arrangement.

with a 10:1 high-impedance input probe to minimise loading and detuning. The oscilloscope was AC coupled to remove the DC component.

Now comes the switch-on time. It is advisable to disable the PA stage while the transistor circuitry is set up. This is most easily done by removing the 12BY7 valve from its socket. To remove the possible hazard from the +300 volt HT line, the centre-tap of the power transformer can now be temporarily lifted from earth. The primary 230V mains wiring (which should have been appropriately protected during construction) will now be the only dangerous potential present (I am assuming it to be unlikely that you could become connected across the extreme ends of the HT secondary winding). The first thing to check is that the +12 volt line is active. Next check the voltage drop across R35 in the power supply and compare the result with Table 2. S2 should be in the SSB position for this.

I suggest that you start with the 9 MHz crystal oscillator. Hold the wavemeter near L1, and set the wavemeter to 9 MHz. Run the slug of L1 throughout its range and a wavemeter deflection should be detected. The control range of the slug should be such that the oscillator drops out of oscillation with the slug fully in, and with the slug fully out. Set the slug to about half-way between these positions and leave it set for the moment.

Now check the VFO. With the VFO capacitor fully meshed, set the wavemeter to 5.0 MHz. Turn the VFO capacitor to minimum capacity and check with the wavemeter that the VFO frequency has moved to 5.5 MHz or higher. A receiver with a calibrated dial is useful here for checking the exact VFO tuning range. L6 and C26 should be adjusted and changed so that 5.0 to 5.5 MHz is covered with some leeway available at each end (say 50 kHz beyond each end).

Both oscillators should now be working satisfactorily. So far so good!

Now check the path from the 9 MHz crystal oscillator through the balanced modulators to the mixer. Turn both carrier balance potentiometers to an extreme end. Hold the wavemeter alongside L4. Set wavemeter reading to 9.0 MHz. Now set the two carrier balance pots to a midway position and try adjusting them for a minimum wavemeter deflection. If a minimum cannot be located, adjust the oscillator slug L1. When a minimum has been located, unbalance one pot a little and repeak L4 for a maximum on the wavemeter. The aim is to locate a balance point (i.e., a dip point) on both balance pots which is somewhere near the centre of their tracks, and at the same time peak L4 for maximum deflection when slight unbalance of one of the pots is made. It sounds confusing, but it is more difficult to explain than to do.

Now move to L8. Unbalance one of the carrier balance pots. Set the wavemeter to 9 MHz and hold it alongside L8. Adjust L8 for a maximum wavemeter reading.

Now move to L7. Set the wavemeter to somewhere between 3.5 and 4.0 MHz and at the same time run the slug of L7 throughout its range. Peak L7 and the wavemeter on the signal when you have located it.

It is now possible to give a final adjusting peak to L4 and L8 with the wavemeter held

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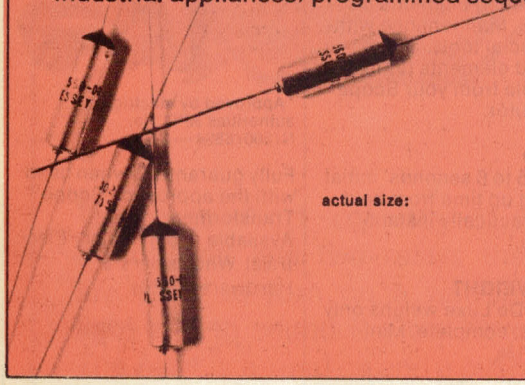

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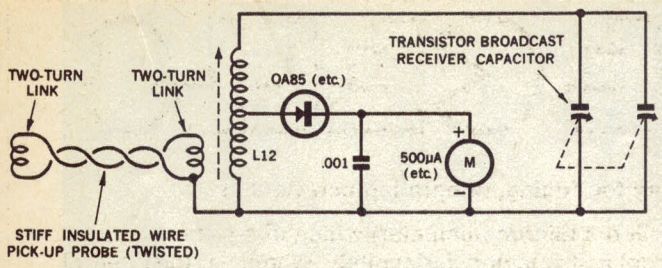


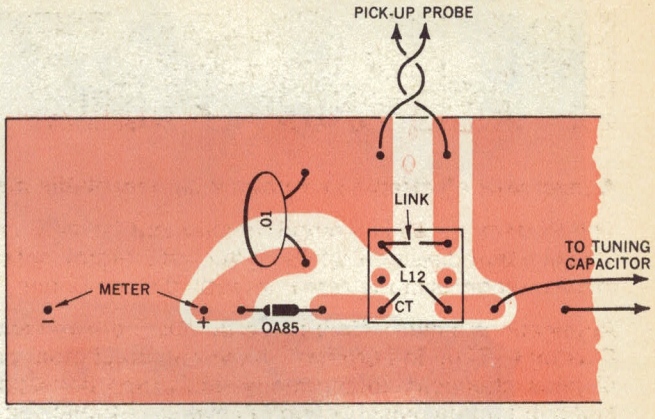




*Figure 15 (above) and figure 16 (right): The circuit and wiring diagram of the small wavemeter used for alignment of the rig. Although shown here on a printed wiring board, this is not necessary and we do not plan to make the pattern available.*

in this position alongside L7.

Check that the carrier balance pots can null the signal from L7 by returning both pots to their balance point (i.e., look for null indication on the wavemeter — which is still held alongside L7 and tuned to somewhere between 3.5 and 4.0 MHz). If you cannot get a null indication with this check, then L7 may be tuned incorrectly to the direct VFO signal. If the wavemeter is correctly calibrated then of course this should be unlikely. The signal at L7 should vary in frequency as the VFO tuning capacitor varied, and should vary in amplitude as each carrier balance pot is run throughout its range, and should be able to be nulled out with both carrier balance pots positioned somewhere near the centre of their tracks.

Let us ignore the audio board for the moment and try the PA stage. Plug in the 12BY7. Switch off the mains supply and reconnect the transformer centre-tap. Connect the dummy load to the antenna socket. Switch on, and check the +300 volt supply (i.e., the voltage across C48). Unbalance one of the carrier balance pots. Run the PA tuning capacitor through its range. At some point the front-panel meter should deflect. The aim now is to adjust L7, C44 (PA tuning capacitor) and S3 (antenna loading) for a maximum reading on the front-panel meter. If the meter tries to read backwards off the scale, then reverse D6.

Once a deflection on the panel meter is obtained, then L4, L8, L7, C44 and S3 can all be adjusted for maximum meter deflection. Vary the VFO frequency and retune L7 and C44. Confirm that C44 is tuned to the 80 metre (3.5 to 4.0 MHz) signal and not to the direct VFO signal, by balancing the carrier balance pots once more. The panel meter indication should drop to a very small indication indeed.

It is unlikely that the meter can be made to indicate zero at this test. This is because some VFO signal (5.0 to 5.5 MHz) will probably be sneaking through the PA to the antenna. L11 is a VFO trap and this should now be adjusted so that the meter reading returns to zero with a sharp "notch" characteristic with L11 slug adjustment. With L11 correctly adjusted, it should be possible to balance the carrier balance pots for zero output on the panel meter.

Now switch S2 to "tune" position and the panel meter should indicate a large reading. In the "net" position is should only indicate a very small deflection.

S2 should now be used to provide the "tune" signal when required. The carrier balance pots can now be kept balanced — these are both set in the "SSB" position of S2 for a null on the panel meter.

The neutralising capacitor (Cn) consists of three turns of plastic-covered hook-up wire wrapped tightly around the anode lead to the valve. The stage should be quite stable with this arrangement. If it is noticed that the meter shows an indication when an output signal is not expected, then the wavemeter should be used to check the frequency of any undesired oscillation. The neutralising could be adjusted by either changing the value of Cn or the value of C36, until the stage is perfectly stable, irrespective of the setting of any of the controls. The voltage reading at the 12BY7 cathode test point (on a 0-10 voltmeter) can be read directly as 0-100 mA anode current.

So much for the RF circuitry. The audio board can now be investigated. It is assumed that you will already have checked the audio oscillator out on an amplifier of some sort to satisfy yourself that it is operating.

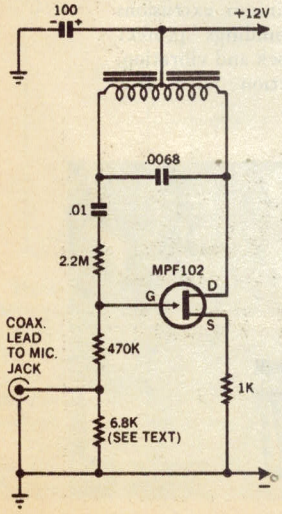
Plug the audio oscillator into the microphone socket and connect its DC supply to an external DC source or to the +12 volt line in the transmitter itself. Turn the audio gain control to its minimum output end, switch the function switch S2 to the "SSB" position and check the carrier balance pots, adjusting if necessary for zero carrier signal output as indicated on the panel meter. Now advance the audio gain control. The meter should commence to read and smoothly increase until the audio gain pot reaches its maximum position. (The reading should be somewhere between half and three-quarters of the meter reading obtained when S2 is in the "Tune" position).

If the meter reading "flattens off" (i.e., does not continue to increase) before the audio gain control reaches its maximum, then one of the stages is being overdriven and a closer examination will have to be made. This may be happening in an RF stage or an audio stage. If the wavemeter (set to 9 MHz) is held near L8 and the test repeated, it can be determined if the "flattening" is occurring in the signal path **before** L8 or **after** it. Operation in this flattening condition is not proper and some reason for it occurring will have to be found. The signal level from the audio oscillator may be too great and could be the reason.

The second and third tests on the audio stage are very similar and I have dubbed them the "break lead E" test, and the "break lead F" test, respectively. These are the two audio leads to each balanced modulator. The initial condition for each test is to feed the tone into the mic. socket (as before) and advance the gain control to maximum as before. Note the meter reading. If lead E is broken (unsolder it at the sideband switch) then the meter reading should drop to approx. 0.63 of its previous reading. Replace it, and do the same again with lead F. Similar reading changes should be obtained with each test. The settings of the preset pots (P2 and P3) on the audio board can affect all readings so do not be too fussy with these measurements at this stage.

If these four tests are satisfactory, i.e.,

1. The steady increase in meter reading as the audio gain control setting increases.
2. The relative meter levels with the gain



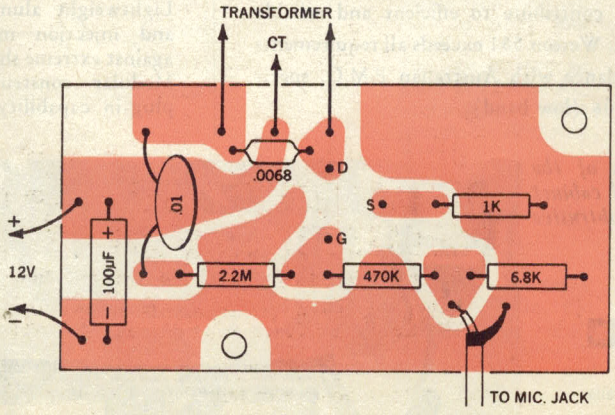




*Figure 17 (left) and figure 18 (above): The circuit and wiring diagram for the test tone oscillator. Again the wiring board is not really necessary.*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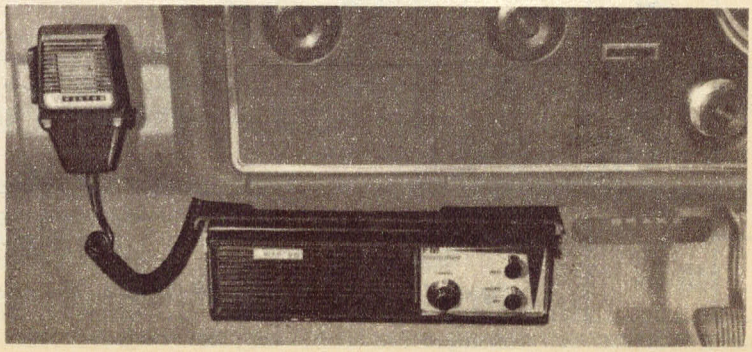

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control at maximum and that with S2 in the "tune" mode,

3. The "break lead E" test, and finally,
4. The "break lead F" test,

then the rig can be considered suitable for alignment and regarded as relatively bug-free!

A microphone can now be plugged into the microphone socket. The meter needle should flicker to a large reading when a short whistle is delivered into the microphone (with rig on "SSB" and with the gain control advanced).

The basic setting-up arrangement for alignment of the rig requires the audio oscillator to be fed into the microphone socket, the rig on "SSB" and the dummy load connected to the transmitter output socket. If the oscilloscope is to be used then the scope is connected across the load. Sufficient Y-amplifier gain should be used to produce a display that two-thirds fills the screen. The horizontal time-base should be set to about 1 mS per cm or similar so that 1000 Hz variations in carrier amplitude will be visible. It may be found advisable to use the external trigger or sync facility and lock the timebase direct from the audio oscillator.

If the receiver method is to be used, then the above basic setting-up is the same except that an AM-type receiver is used to listen to the transmitted signal. It is important to realise that no overloading of the RF stages of the receiver can to tolerated. This can be ensured by turning the receive audio gain up to maximum and turning the receiver RF gain down. It may even be necessary to put a direct short between the receiver aerial and earth to prevent any possibility of overload.

Irrespective of whether the oscilloscope or receiver method is to be followed, the controls to be adjusted are: P2, P3, C20, L3, and L1. P2 and P3 are the prime controls, but some changes in C20 and L1 may be found desirable. L3 can be inserted and tried as well. The carrier balance pots P4 and P5 will also probably require some adjustment from time to time. R13 may need to be changed too.

Now for the philosophy of the alignment! The oscilloscope and receiver are really only being used as indicators, so the alignment method is really the same in each case. It is just the interpretation of the indicated results on the scope or receiver that is different.

If a pure sinusoidal tone is fed into the microphone socket, then the ideal SSB output signal should consist of a single "carrier" (on either the USB or LSB position, depending upon the position of S1). The adjustments made to P2, P3 (etc) are made until a pure output is obtained. This means that the carrier is suppressed and the unwanted sideband also suppressed. On the oscilloscope we should see a stripe of constant-height. The controls should be adjusted until all visible "ripple" is eliminated. On the receiver we should hear the same signal we would hear from a cw station with his key held down — a steady carrier.

It is perhaps easiest to use the receiver with its BFO "off". This enables the audio beat-notes between the wanted sideband and the residual carrier (1 kHz pitch) and the wanted sideband and the unwanted sideband (2 kHz pitch) to be heard. Both

## TABLE 1 — COIL DATA

Coils L1, L4, L6, L7, L8, L11 and L12 are wound on ¼ inch slug-tuned formers.

L1 — 20 turns 28 SWG, enamelled, close-wound.
L2 — 6 turns 28 SWG, enamelled, close wound over "cold" end of L1.
L3 — About 6 turns of 28 SWG, wound direct on to a ¼ inch slug. This coil may not be necessary (see text).
L4 — 6 turns 28 SWG, bifilar wound. 3 turns in each half-winding.
L5 — Two turns hook-up wire wound over centre of L4. This same wire forms the twisted link to the mixer board.
L6 — 42 turns 28 SWG, enamelled, close-wound.
L7 — 40 turns 28 SWG, enamelled, close-wound.
L8 — 20 turns 28 SWG, enamelled, close-wound.
L9 — 3 turns 28 SWG, enamelled, wound over "cold" end of L8.
L10 — 40 turns 28 SWG, 2 inches diameter, spaced over 3¼ inches. Tapped at 1, 2, 4, 6, 8, 10 turns.
L11 — 35 turns 28 SWG, enamelled, close-wound.
L12 — 40 turns No. 32 SWG, enamelled, close-wound, tapped at 20 turns.

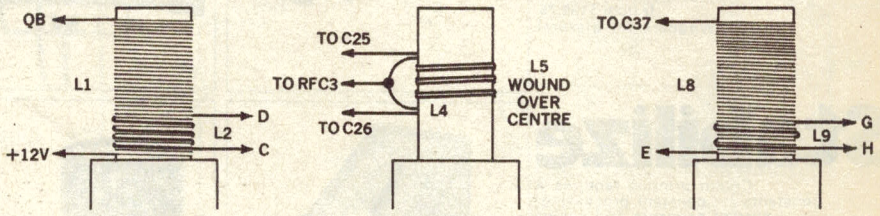


*Figure 19: Winding details for the various coils used in the Tucker Tin rig. Note that L4 is formed from three bifilar turns.*

these pitch notes can be readily identified by ear and the appropriate controls (etc.) adjusted until there is no sign of any beat note at all.

Time spent on these tests and adjustments is being wasted if there is any overloading occurring at any point in the circuit. So keep the audio gain down while making these adjustments. Several good general-type articles on the alignment of SSB transmitters have appeared in the amateur literature and I recommend that you study these in order to appreciate the various effects that you may notice during alignment — too time-consuming to be dealt with here.

This alignment phase should not take long. It is unfortunate that it is a process that is difficult to describe, and yet is fairly easy to accomplish once you have tried it or seen it carried out. It is rather like learning to ride a bicycle from a text-book!

Once the rig is aligned and ready for on-the-air tests, the send-receive switch S2C can be connected into the receiver so that operation of S2 turns the receiver off and the transmitter on, and vice versa, as required. S2C could be used to operate an external relay. This relay could perform the aerial changeover function (i.e., switch the antenna between transmitter and receiver) as well as disable the receiver when on transmit. I consider it simpler to use two antennas — the main one for the transmitter, and a random wire for the receiver. This eliminates the antenna changeover problem. S2C can then be used to switch the receiver on and off as required, giving a single-control station.

Your own ingenuity will soon produce an effective solution to the send-receive problem with your particular receiver.

Caution is necessary with on-air tests. There are several traps that you could come up against and should be aware of.

The first concerns operators. It is absolutely pointless in getting checks from an inexperienced sideband station. Many

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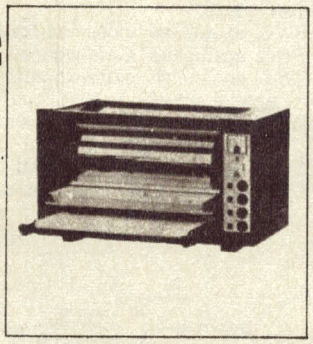

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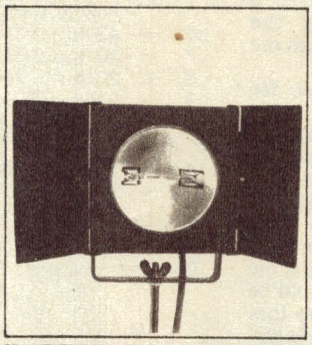

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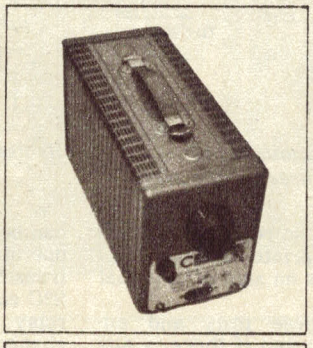

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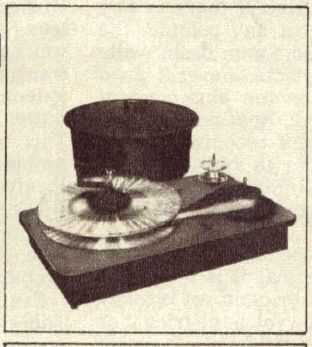

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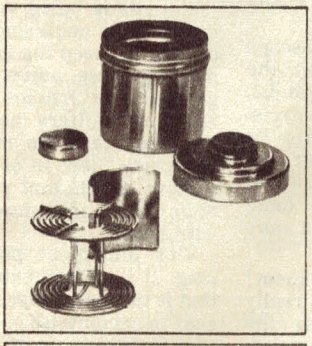

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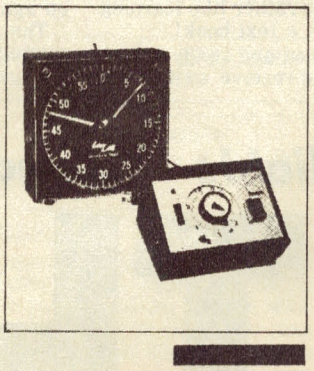

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| Point | Voltmeter | Oscilloscope PK to PK |
|---|---|---|
| **1. POWER SUPPLY** | | |
| (a) Junction R33 and C48 (nominal + 300 v line) to earth | +295 v. D.C. | — |
| (b) Junction R35 and C51 (nominal + 12 volt line) to earth | +13 v. D.C. | — |
| (c) Voltage drop across R35 (from which the total transistor section load current can be calculated) | 2.3 v. D.C. | — |
| (d) Heater voltage | 6.6 v. A.C. | — |
| **2. AUDIO BOARD** | | |
| (a) Microphone socket | — | 40 mV |
| (b) Gate Q1 | — | 40 mV |
| (c) Source Q1 | 2.2 v | Approx. 40 mV |
| (d) Drain Q1 | 9.7 v | 400 mV |
| (e) Junction R5 and R6 | 0.35 v | Approx. 200 mV |
| (f) Emitter Q2 | 11 v | 300 mV |
| (g) Collector Q2 | 7.4 v | 2.6 volts |
| (h) Junction R9 and C9 to earth | 12.3 v | — |
| (j) Top of Mic. gain pot | — | 2.1 volts |
| (k) Base of Q3 to earth | 1.4 v | 2.1 volts |
| (l) Collector Q3 to earth | 6.2 v | 8.1 volts |
| (m) Emitter Q3 to earth | 1.2 v | 1.2 volts |
| (n) Gate Q4 to earth | — | 2.6 volts |
| (o) Gate Q5 to earth | — | 2.8 volts |
| (p) Source Q4 to earth | 2.2 v | 1.2 volts |
| (q) Source Q5 to earth | 2.2 v | 1.2 volts |
| (r) Lead A to earth | — | 1.2 volts |
| (s) Lead B to earth | — | 1.2 volts |
| (t) Junction R15 and C13 to earth | 12.8 v | — |
| **3. CRYSTAL OSCILLATOR BOARD** | | |
| (a) Base Q6 to earth | 2.0 v | 6.2 v |
| (b) Collector Q6 to earth | 12.5 v | 16 v |
| (c) Emitter Q6 to earth | 3.7 v | — |
| (d) Lead C to earth | — | 3.2 v |
| (e) Lead D to earth | — | 3.3 v |
| **4. BALANCED MODULATOR BOARD** | | |
| (a) Junction L4 and C25 to earth | — | 0.4 v |
| (b) Junction L4 and C26 to earth | — | 0.4 v |
| (c) Lead G to earth (with point H deliberately earthed) | — | 0.2 v |
| **5. VFO/MIXER BOARD** | | |
| (a) Source Q7 to earth | | 11 v |
| (b) Base Q8 to earth | 4.2 v | 6.2 v |
| (c) Emitters Q8/Q9 to earth | 3.8 v | 6.0 v |
| (d) Base Q9 to earth | 2.0 v | Approx. 0.5v* |
| (e) Collector Q9 to earth | 12.6 v | 15 v* |
| **6. POWER AMPLIFIER STAGE** | | |
| (a) Pin 2 (Grid) of 12BY7 to earth | — | 16 v* |
| (b) Cathode test point to earth | +4.1 v (41mA) | 2.1 v* |
| (c) Pins 1 and 9 (Cathode) to earth | +6.6 | 4.1 v* |
| (d) Pin 8 (Screen) to earth | +260 | — |
| (e) Pin 7 (Anode) to earth | +290 | 350v* (approx.) |
| (f) Fixed Plates C43 to earth | — | 350v* (approx.) |
| (g) Antenna lead to earth | — | 43 |
| (h) RF indicator meter reading (rig front panel) | 0.82 mA | |
| (i) RF Wattmeter reading (75 ohm load) | 4.1 watts | |

*.Signal pattern is distorted by the presence of VFO signal.

operators of sideband equipment know nothing of the technicalities of sideband transmissions. Checks with these stations usually result in confusion at both ends of the transmission. You will get worthwhile checks from technically experienced sidebanders only, so pick on an operator who has built his own equipment at some time and who knows what he is about.

The second concerns receivers. It is pointless trying to get a check on sideband suppression from a station who does not possess a receiver with a good quality SSB filter. You cannot use a receiver that lacks a filter (i.e., an AM receiver) to check on sideband suppression.

The third concerns receivers and intermodulation. Some commercial SSB receivers (and transceivers) suffer from poor intermodulation performance in "the front end". This can be minimised by the receiver operator turning his RF gain control down, turning the receiver audio gain control fully up, and using the RF gain to set the signal level from the speaker. Many operators seem reluctant to do this (probably because the "S" meter is no longer useable)! Sideband suppression checks made with an SSB receiver in this condition are generally useful.

The fourth trap concerns the method used to switch sidebands while checking suppression. It is generally more convenient for a phasing transmitter to switch sidebands (because it swaps to the other side of the fixed carrier frequency) than for a filter-type transceiver to switch sidebands while on receive. Some filter rigs exhibit "carrier shift" when switching sidebands. So I recommend that if you want a sideband suppression check, that you work an experienced SSB station with a receiver that contains a good-quality filter. Call him on "lower sideband" and then switch to "upper sideband" for a further call (say 30 seconds) and then switch back to the lower sideband. If your sideband suppression is ideal, then he should not have heard a thing for the 30 second period that you were on upper sideband.

Carrier suppression checks can be made by asking the receiving station to tune across your signal and listen for a steady beat-note (your carrier beating with his receiver carrier-insertion oscillator or BFO).

The audio gain control should be advanced with caution. It can be roughly set by noting the meter reading when in the "tune" position. With speech input it should dither about ONE-QUARTER of this reading. This is because an SSB signal is very "peaky". Flattening of peaks can cause splatter so it is advisable to keep the gain well back so that the high peaks are accommodated without clipping. The meter will not respond to speech peaks — it follows the average output signal level on speech.

Incidentally, lower sideband is the mode generally used on the 80 metre band.

As promised earlier, details will now be given of a modification to permit the rig to be used for AM operation. AM can be provided in one of two ways. "Compatible AM" (i.e., one sideband plus carrier) can be provided by simply unbalancing one or other of the balance pots. Care must be exercised to ensure that adequate carrier is provided and yet ensure that the linear PA stage is not overdriven. This means that the mike audio gain will have to be turned well back from its usual SSB position. The meter should indicate a carrier level of about half the deflection shown in the "tune" position.

## STEP DOWN TRANSFORMERS

| SECONDARY VOLTS | TYPE NO. | RATING VA. | RATING AMPS | DIMENSIONS H. | DIMENSIONS W. | L. | WEIGHT LBS. |
|---|---|---|---|---|---|---|---|
| FUSEMASTER RANGE — Enclosed In Steel Cases | | | | INCHES | | | |
| 6 | TS6 60B | 60 | 10 | 5 | 3⅜ | 7 | 6½ lb. |
| 12 | TS12 12B | 12 | 1 | 2¼ | 2⅝ | 5⅜ | 2 lb. |
| 12 | TS12 30B | 30 | 2.5 | 4½ | 3 | 6 | 4 lb. |
| 12 | TS12 60B | 60 | 5 | 5 | 3⅝ | 7 | 6½ lb. |
| 12 | TS12 125B | 125 | 10.42 | 5¾ | 4¼ | 9 | 11¼ lb. |
| 24 | TS24 30B | 30 | 1.25 | 4½ | 3 | 6 | 4 lb. |
| 24 | TS24 60B | 60 | 2.5 | 5 | 3⅝ | 7 | 6½ lb. |
| 24 | TS24 125B | 125 | 5.2 | 5¾ | 4¼ | 9 | 11¾ lb. |
| 24 | TS24 200B | 200 | 8.33 | 5¾ | 4¼ | 9 | 14½ lb. |
| 32 | TS32 30B | 30 | .94 | 4½ | 3 | 6 | 4 lb. |
| 32 | TS32 60B | 60 | 1.88 | 5 | 3⅝ | 7 | 6½ lb. |
| 32 | TS32 125B | 125 | 3.9 | 5¾ | 4¼ | 9 | 11¾ lb. |
| 32 | TS32 200B | 200 | 6.25 | 5¾ | 4¼ | 9 | 14½ lb. |
| 32 | TS32 300B | 300 | 9.4 | 5¾ | 4¼ | 9 | 18 lb. |
| 32 | TS32 500A | 500 | 15.6 | 6¾ | 5¾ | 6½ | 26 lb. |
| 32 | TS32 750A | 750 | 23.44 | 8¼ | 6¼ | 6¼ | 38 lb. |
| 32 | TS32 1000A | 1000 | 31.35 | 8¼ | 6¼ | 8¼ | 51½ lb. |
| 115 | TS115 30B | 30 | .26 | 4½ | 3 | 6 | 4 lb. |
| 115 | TS115 60B | 60 | .52 | 5 | 3⅝ | 7 | 6½ lb. |
| 115 | TS115 125B | 125 | 1.09 | 5¾ | 4¼ | 9 | 11¾ lb. |
| 115 | TS115 200B | 200 | 1.74 | 5¾ | 4¼ | 9 | 14½ lb. |
| 115 | TS115 300B | 300 | 2.61 | 5¾ | 4¼ | 9 | 18 lb. |
| 115 | TS115 500A | 500 | 4.35 | 6¾ | 5¾ | 6½ | 26 lb. |
| 115 | TS115 750A | 750 | 6.53 | 8¼ | 6¼ | 6¼ | 38 lb. |
| 115 | TS115 1000A | 1000 | 8.7 | 8¼ | 6¼ | 8¼ | 51½ lb. |
| 115 | TS115 2000A | 2000 | 17.4 | 10½ | 8¼ | 8¼ | 79 lb. |
| SOLDERING IRON TRANSFORMERS — Enclosed in pressed steel cover — suitable for Mico or Oryx Soldering Irons | | | | | | | |
| 5,6,7, 10,11,12, | TS7 20 | 20 | 2.85 | 3⅜ | 2⅝ | 2¾ | 2½ |
| | TS12 40 | 40 | 3.33 | 3⅜ | 2⅝ | 3¼ | 3½ |

All transformers in this range are suitable for connecting to a 240 volts, 50 cycles, single phase supply and, where applicable, comply with Australian Standard C126 1950 under approved Number N158.

**FUSEMASTER RANGE:—**

All transformers housed in steel cases ("A" and "B") fall into the above category.

**A TYPE**

- Fuse protection of output.
- Three core primary flex 6'6" long.
- Conduit or grommet knockouts.
- Primary and secondary terminal blocks.
- Carrying handle.
- Provision for wall mounting.

**B TYPE**

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- Three core primary flex 6'6" long.
- Carrying handle.
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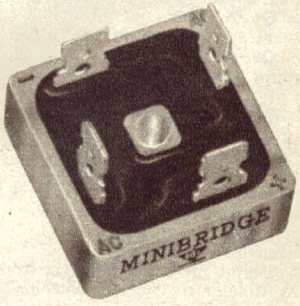


***FEATURES***

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|---|---|---|---|---|---|---|---|
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| PIV / leg | 50V | 100V | 200V | 400V | 600V | 800V | 1000V |
| 8A Type | PA05 | PA10 | PA20 | PA40 | PA60 | PA80 | PA100 |
| PIV / leg | 50V | 100V | 200V | 400V | 600V | 800V | 1000V |

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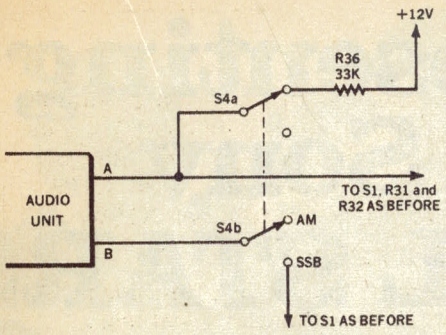


*Figure 20: Details of the simple modification required to adapt the rig for AM operation, as explained in the text.*

"Compatible AM" presents a puzzle for some receiver operators. It should be tuned in for best received audio quality and not greatest S meter reading.

A more elegant method which produces double sideband plus carrier (i.e., AM) is shown in figure 20. (This diagram with the additional components shown is an extension of the previous numbering system). S4 can be a double-pole double-throw toggle switch mounted wherever you like. S4b removes the audio feed to one of the balanced modulators when S4 is in the AM position. S4a applies DC bias to the remaining balance modulator to unbalance it and hence provide carrier. "Netting" must be done with S4 in the SSB position (to prevent R36 shorting R31). Tests show that if the rig is set up for SSB (i.e., S4 in SSB position, both carrier balance pots adjusted for balance, and the mike gain set for the correct level for SSB) then when S4 goes to the AM position both carrier and sideband levels are about right for AM. S1 can be left in either position for AM.

The meter should read about half the "tune" reading when on AM and with negligible flicker with modulation.

It must be realised that the power output limitation of about 4 watts PEP output also applies to AM, so mean RF output power on AM is therefore only 2 watts. Two watts AM is a poor servant compared to 4 watts PEP SSB and the results obtained with the rig on AM will reflect this. It was this decrease in performance that swayed the decision to omit AM from the original design. However, if constructors must have AM then this modification should suffice.

I have hooked up the circuitry shown in figure 20 to the prototype to check it out and it works as expected. I worked three stations (two in Auckland) on AM and all had SSB receivers copying me as SSB Finally I phoned a local ham who I knew had an AM receiver and got him to check it out! This makes me wonder if anyone still uses AM or needs this modification! All reports on AM have been satisfactory, but I will not be permanently modifying my rig.

The time of writing is too early to expect any other constructor to have another rig on the air so it is probably appropriate to mention again the problem of spread in transistor parameters Some changes to the values of R7, R10, R13 or R14 and R23 may be found necessary. Only time will tell. I am interested to receive comments and experiences from other constructors of this rig on this matter in particular.

The carrier balance stability of the prototype is the best I have ever experienced with a phasing rig. I went overseas for six weeks and used the rig for two nights after getting back before realising that I had not touched the carrier balance pots since going away!

That just about covers the field and all I can do now is to wish you well. If you strike difficulties, I suggest that you use some of that scarce commodity, patience, and try and reason out the problem for yourself. The RSGB "Radio Communication Handbook" has a good section on SSB and on the adjustment of a phasing rig (page 10.48).

I wish to thank all who have assisted me with the development of this project — both on and off the air. In particular Denis, ZL2AVK, for technical assistance, and Glen, ZL2KY, for taking and producing the photographs.

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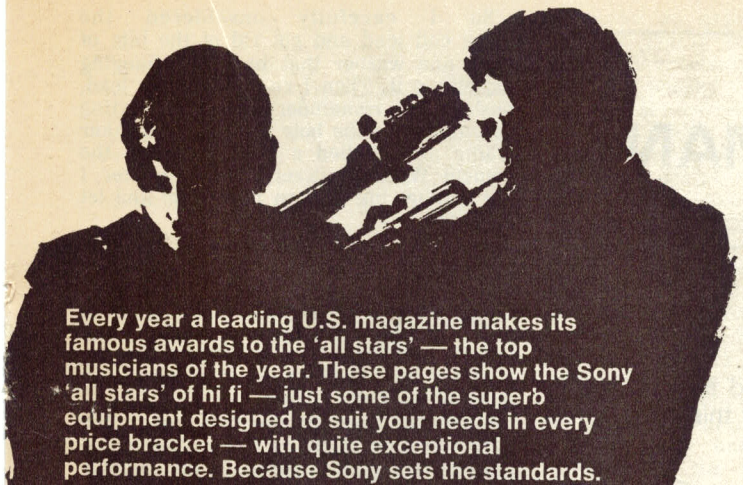

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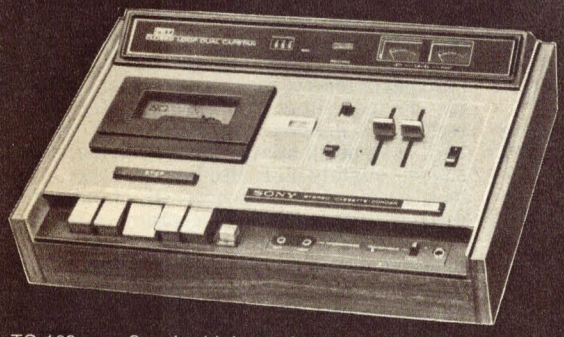

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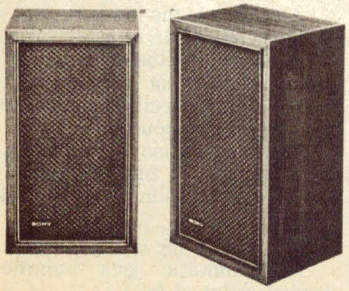

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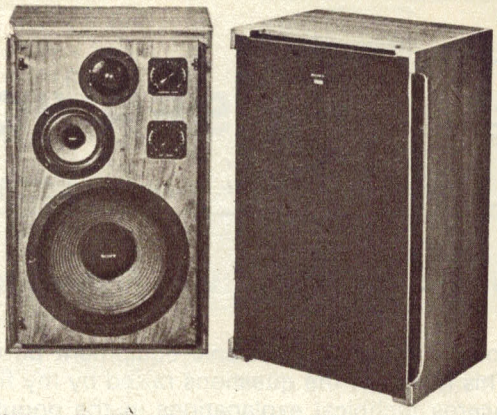

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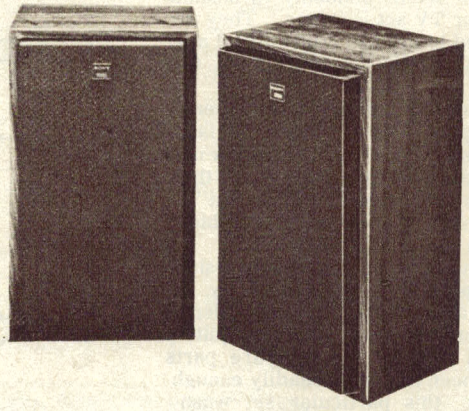

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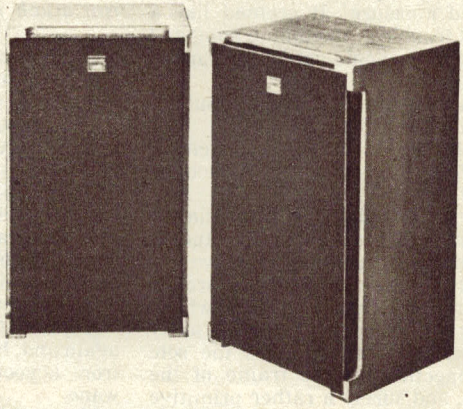

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# THE SERVICEMAN

## *Repairing a radio that was "Finished"*

When should a piece of electronic equipment be discarded as "not worth fixing"? This is one of the questions raised by my first story this month. The other concerns technical explanations in the popular press.

I've mentioned before the kind of customer who seems suddenly to assume that a radio or TV set is "done". They are quite prepared to discard it and spend a lot of money on a new set, purely on this assumption.

I encountered the situation again recently when visiting an elderly couple socially. They asked my advice about buying a new transistor radio, explaining that their present radio was "done . . . finished".

"It's quite old, and you wouldn't be able to get the parts for it now, anyway!"

In fact, the set was a medium-sized transistor portable, produced by an Australian manufacturer and sold under at least two brand names. I knew it as quite a good type of set, for which spare parts should have been available readily enough.

To be sure, this particular set wasn't behaving itself. One had to handle the dial very gingerly when tuning, the stations seeming to appear and disappear in the most frustrating way — with lots of crackling for good measure! It seemed like a clear case of trouble in the tuning gang and I suggested that it should not be too hard to rectify.

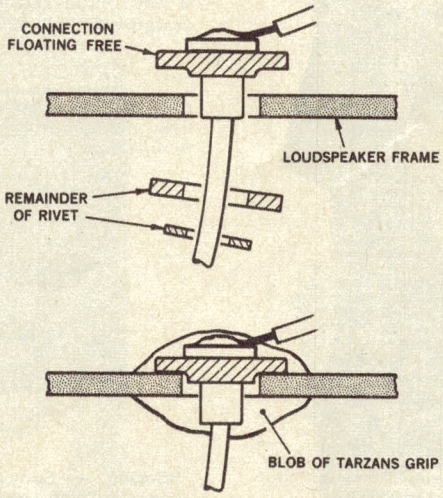
Why buy a new set — which they could ill afford — unless they had to?

So I took the set away and, next evening, removed it from the cabinet and looked for the cause of the trouble.

Actually the trouble was immediately obvious — and rather surprising. The tuning gang was mounted to the printed wiring board by three screws passing through rubber grommets. Under one screwhead was a solder lug with a wire running away to the copper pattern; this was the sole "earth" connection for the frame of the tuning gang, and surely a rather primitive one.

The trouble was simply that the rubber grommet had deteriorated somewhat, reducing the contact pressure between the screw head and the solder tag. In consequence, movement of the capacitor occasioned by tuning caused intermittent contact, allowing the gang to float free, or partially free, of earth. No wonder stations tended to appear and disappear; no wonder the crackling!

While I corrected the fault by an extra turn of the offending screw, it still seemed to me a rather primitive way of establishing a vital connection to the gang frame. So I soldered a flexible wire to the frame, drilled a small hole in the board and soldered the other end of the wire to the copper pattern. I




*A diagram of the faulty loudspeaker connection and how it was fixed without too much trouble. See first story.*

was reasonably sure that the trouble would not re-occur, even through the grommet might lose still more of its elasticity.

That should have been the end of the story, involving only a few minutes' work — but, alas, it wasn't.

When I re-installed the set in its cabinet, I was horrified to hear more crackling. This time the crackling was sensitive, not to the tuning knob, but to pressure on one corner of the wiring board.

Surely not a hair crack in the pattern!

Anyhow, the whole thing had to come out again and, by this time, the virtuous feeling from a good deed done was beginning to wane.

More prodding with the set partially dismantled finally tracked the new trouble, not to the board, but to a loudspeaker connection tucked away under one edge of the board. The insulated rivet in the loudspeaker frame providing a connection to one end of the voice coil had let go, allowing the body of the rivet, or the wire passing through it, to rub on the frame.

How do you fix a thing like that, short of a major operation — and then not without some danger to the cone and its frail connections?

It was then I thought of the tube of "Tarzan's Grip" on the shelf — the quick drying acetone cement beloved of aircraft modellers and people with broken spectacle frames!

So I carefully unsoldered the voice coil lead and got rid of the bits of rivet and washer that had been hanging loosely on it. Then I re-soldered the lead, pushed the remainder of the insulating assembly into the hole in the loudspeaker frame and applied a liberal dab of the cement. When it was set, some time later, I put another big blob on the inside and let that set.

Next morning it seemed quite firm and thankfully I put the receiver back together again.

This time, there were no more crackles and the elderly couple seemed almost convinced that the set was better than new.

All for the sake of a piece of wire and two blobs of Tarzan's Grip!

My second story this month is more in the nature of a comment on the way technical matters are often treated in the popular press.

As many of my readers may realise, one of my pet hates is the type of story which turns up in print when the average newspaper tries to explain a technical point for the benefit of the layman. For the technically minded reader the result may vary from being faintly amusing to making one feel slightly ill. It also has the effect, at least as far as I am concerned, of raising serious doubts as to the accuracy of other articles, on subjects of which I may be ignorant, which appear in the same journal.

Of all the subjects which are so treated, the one concerning decibels must surely be the most abused. Never yet have I seen a newspaper explanation which comes even close to grasping the basic principles behind this measuring unit.

Recently my attention was drawn to yet another such article which appeared in a weekly newspaper which circulates in two districts south of Sydney. For the benefit of interstate readers I should perhaps explain that these two districts are situated close to Mascot airport, and there is a lot of local concern about the noise levels from jet aircraft, both now and in the future. As a result, decibel levels tend to crop up fairly regularly, in the various reports from local committees, local government bodies, and DCA.

It was against this background that the paper's columnist set out to explain the mysterious decibel for the benefit of his readers. And a very worthy motive too, if only he could have straightened the story out in his own mind first.

This is his version:

"With air noise and road noise vying for the limelight, here is an interesting fact on noise decibels.

"Sound is measured in decibels or tenths of a bel (after Graeme Bell, telephone inventor).

"A decibel is the lowest sound detectable by the human ear in quiet surroundings.

"Because decibels increase logarithmetically and not arithmetically, an increase of three decibels would mean double the intensity of sound.

"The human annoyance margin is from 50 to 90 decibels, a figure deduced from the Conservation Foundation in Washington, DC.

"The pain limit is 120 decibels.

"A pneumatic jack hammer has a decibel count of 94.

"A jet plane on take off has a decibel count of 150.

"The sound of traffic in a fairly quiet city street is 70 decibels, and this count is also regarded as a health hazard.

"So, apply these figures where you will — the results should be startling."

Before dealing with the above discourse in detail, suppose we go right back to the beginning and find out where this decibel business started, and what it is all about.

In the early days of telephone systems, particularly trunk lines, telephone engineers encountered the need for a measuring scale which would indicate, in practical terms, the losses in telephone lines.

While, at first glance, it might appear that all that was required was a metering system which would indicate the power of the received signal (in, say, milliwatts) which could then be compared with the power of the transmitted signal, they encountered a serious snag when trying to put it into practice. The snag was simply this: having made your measurement how did you interpret it? For example, suppose that a particular line was shown to deliver only half the power, at its far end, that was fed into it at the near end. Just what would this mean in terms of user reaction?

A natural assumption would be that it would create a subjective reaction of "half as loud". In fact, this is not so. If listening to a steady tone, the observer would more likely rate such a change as "just noticeable". If listening to a voice he may not notice the change at all, unless he was expecting it. The same would apply for an increase in the same ratio (two to one) from the original level.

In short, the ear responds logarithmically to changes in sound energy. (I can find no reference to the word "logarithmetically", but perhaps we can blame that on the compositors.)

Thus, losses which appeared catastrophic on a simple power measurement basis were shown to be negligible on an audible basis. As a result, engineers evolved a logarithmic scale which would express in figures what was appreciated subjectively. And so the Bel and, ultimately, the deci Bel were born.

But note this particularly. The decibel has no absolute value. It is simply a unit of loss or gain. "Zero dB", the reference commonly employed, can represent any value which an engineer, at any particular time, considers convenient. It is simply the reference level against which he wishes to compare the behaviour of a piece of equipment.

In practice, a number of common references have emerged, usually peculiar to a certain segment of the industry. Thus the PMG's Department has a zero reference of 1mW in 600 ohms, while broadcast engineers have favoured, at least in the past, a figure of 6mW in 600 ohms.

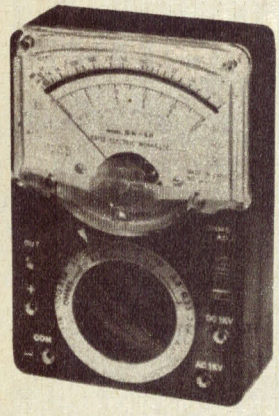
In the sound measurement field zero reference is based on the threshold of hearing; this, in turn, being defined as a precise energy level based on the average of a number of observers. More precisely, a sound pressure level of .0002 dynes / sq cm.

To be strictly accurate, one should never use the decibel scale to indicate absolute values, unless the reference level is quoted. In practice this is usually honoured more in the breach than the observance, simply because, to those in the particular sphere, the reference is "understood". This adds

(Continued on page 125)

# NEW RH (Radio House) RANGE OF MULTIMETERS

## MODEL RH-60 $25.00. Postage 50c

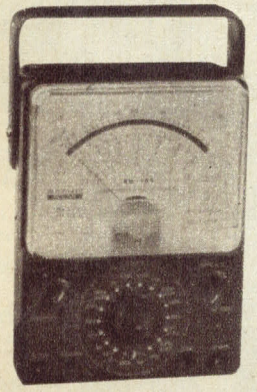


50,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.
**Specifications:**
DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25uA, 5mA, 50mA, 500mA.
Resistance: 10K, 100K, 1M, 10M.
Decibels: —10 +62dB.
Accuracy: DC ±3 p.c., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

## MODEL RH-100 $39.75. Postage 75c

**100,000 Ohms per Volt DC 10,000 Ohms per Volt AC**

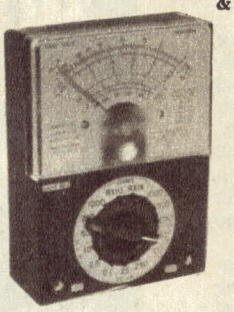
• Overload protected by dual silicon diodes • Double-jewelled ± 2 per cent meter • ± 1 per cent temperature-stabilised film resistors • Polarity changeover switch • Mirror scale • Instructions for operation with circuit diagram.



**SPECIFICATIONS:**
DC Volts: 0.6, 3, 12, 60, 300, 600, 1200 (100,000/V).
AC Volts: 6, 30, 120, 300, 1200 (10,000/V).
DC Current: 12A, 300A, 6mA, 60mA, 600mA, 12 amps. AC Current 12 amps.
Resistance: 20K, 200K, 2M, 20M.
Decibels: —20 to +17, 31, 43, 51, 63.
Accuracy: DC ±3 per cent. AC ± 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

## "HANDYMAN" RH150 $11.50

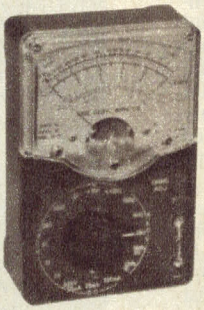
**CHECKED PACKED & POSTED FREE**



Pocket-size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

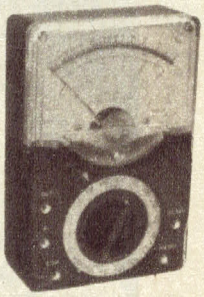
**SPECIFICATIONS:**
DC Volts: 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: .1, 25, 250mA.
Resistance: 20K and 2M.
Decibels: —20db, +62dB, 0.7KHz.
Capacitance: .0001, .01, .0025, .25uF

## MODEL RH-55 $20.00. Postage 50c



30,000 Ohms per Volt DC
14,000 Ohms per Volt AC.
**Specifications:**
DC Volts: 0.6, 3V, 12V, 60V, 300V, 1200V
AC Volts: 12V, 60V, 300V, 1200V.
DC Current: 60uA, 12mA, 300mA.
Resistance: 10K, 1M, 10M.
Decibels: —10dB, +23dB.
Overload protected.

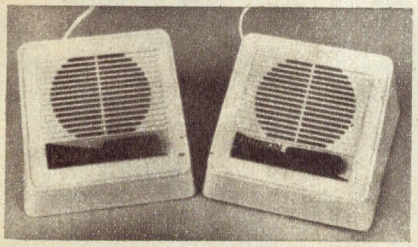
## MODEL RH-80 $18.00. Postage 50c.



20,000 Ohms per volt DC.
10,000 Ohms per volt AC.
**Specifications:**
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: —10dB + 62dB.
Accuracy: DC 3pc.
AC 4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

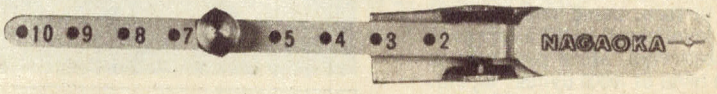
• Overload protected by dual silicon diodes • Double-jewelled ±2 per cent meter • ±1 per cent temperature-stabilised film resistors • Mirror scale.

## $9.50 Posted



As featured in Electronics Australia October 1971, the two-station Edison Intercom.


## STYLUS PRESSURE GAUGE, Balance type NW-501




**$1.50 Posted**

# RADIO HOUSE PTY. LTD.

306-308 PITT STREET 61-3832 26-2817 760 GEORGE STREET SYDNEY. 211-0171

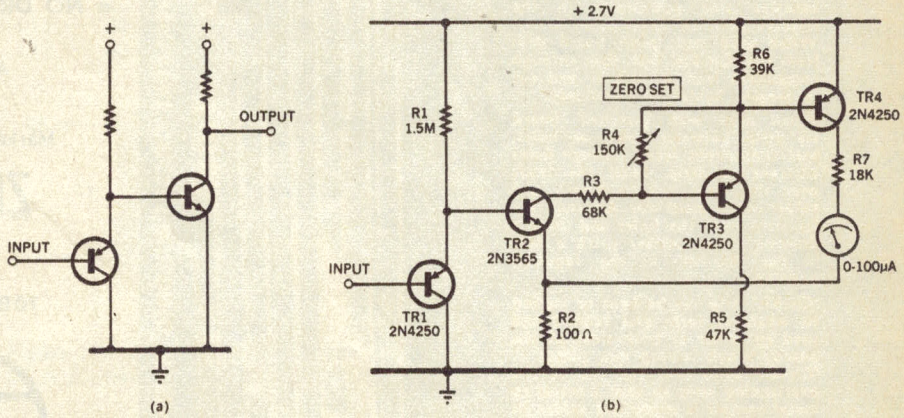
# CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected by the Editor from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome.

## The Mixed Double — and a DC Millivoltmeter

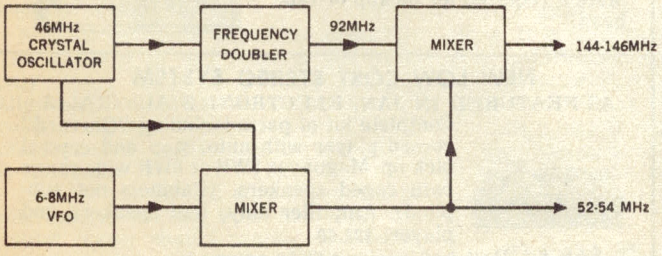
This mixed double has nothing to do with tennis. But it is a promising new circuit technique stemming from Australia and described recently by R. H. S. Riordan of CSIRO in Electronics Letters (August, 1971). It is a new form of balanced input stage which it is claimed overcomes the disadvantages of the long-tail pair, as used in DC amplifiers. In the long-tail pair, the input is not at earth potential unless a split supply is used; furthermore the gain is only half that of an equivalent single transistor stage. The basic arrangement of the new mixed double is shown in figure (a); it will be seen that this uses one PNP and one NPN transistor. A practical application of this circuit to a simple DC millivoltmeter is shown in figure (b). This gives a sensitive voltmeter operating from a single 2.7V battery providing full scale deflection from about 10mV input. The DC amplifier has a loop gain of about 25dB, an input impedance of about 100M and an input offset current of about 5nA, with linearity better than 99 per cent of full scale deflection.

TR1 operates as a common collector stage with TR2 as a common emitter stage. The voltage gain of TR1 is slightly less than unity, but it should have high current gain to minimize the input offset current. The current gain of TR2 is not important, but its high-frequency current gain determines the overall frequency response. Optimum temperature compensation is said to be obtained when base-emitter voltages of the two transistors are equal. With types 2N4250 and 2N3565, temperature coefficients of 70-100uV / degree C were obtained; this is worse than a conventional input stage using matched transistors, but it is adequate for many purposes; much better results might be obtained if transistors were designed for this application. Temperature coefficient of the voltmeter shown is put at about 200uV / degree C, due mainly to the uncompensated stage.




One possible application for a sensitive millivoltmeter of this type might well be as the heart of a transistorized harmonic detector for TVI work — other uses are likely to occur to readers.
(From "Radio Communication".)

## Simultaneous Generator for 52-54 and 144-146MHz




Arising out of the article on the 52-54MHz FM / AM Exciter as described in December, 1971, a reader has come up with the idea of using an extension of this system so that signals may be generated simultaneously to cover 52-54MHz and 144-146MHz. A 46MHz crystal oscillator output is directly mixed with a 6-8MHz VFO to produce an output of 52-54MHz. Also, the 46MHz signal is doubled to 92MHz and this is mixed with the already produced 52-54MHz to give 144-146MHz. The block diagram shows these details.

(Editorial note: This information has been inserted on advice of the idea from a reader in Melbourne. As we do not now have the name and address of this reader, we would appreciate a note from him.)

## Note on the Tone Control Amplifier

In Circuit & Design Ideas for November, 1971, N.W. Giles describes a Tone Control Amplifier which he built. Among other suggested applications, he pointed out that he incorporated this tone control immediately ahead of the power output stage of the Basic Stereo Amplifier, as described in June, 1966.

We have received a letter from Mr. B. Marks, 8 Mott Street, Warrnambool, Victoria 3280, who advises that he has built this tone control into the Basic Stereo Amplifier and he is pleased with the results.

However, Mr. Marks points out that, as there is a phase reversal within the tone control circuit, this must be taken into account when it is introduced within an existing feedback loop. This is the case with the Basic Stereo Amplifier and the feedback connection will need to be reversed.

While we are not particularly in favour of putting a tone control within a feedback loop, there are times when this practice can be justified, particularly on the grounds of simplicity or convenience. It is important to note that both the original author and the present correspondent have found this approach to be satisfactory.

Mr. Giles mentions that if the tone control is to be used for stereo applications, the circuit as shown will have to be duplicated, except for the two decoupling electrolytic capacitors, and the 15K resistor, which latter should be reduced to either 8.2K or 6.8K. Again, Mr. Marks points out that the 22K decoupling resistor should also be halved when two amplifiers are used. Strictly speaking, this is correct. However, if this step were not taken, we doubt whether it would have any noticeable effect on results.

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**SIZES: 1 / 8" and 1 / 16" WIDTHS**

**Length: 100 ft. roll, 5 ft. card**

**IDEAL FOR PROTOTYPE AND PRODUCTION CONSTRUCTION**

**USEFUL FOR WIRING REPAIRS**

• **NO DRILLING** • **FAST** • **NO MESS**

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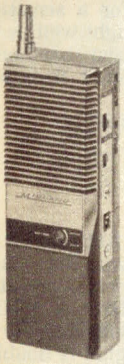


**At last a breakthrough in the cost for high quality portable radio transceivers of the walkie-talkie hand-held type. We are introducing and offering for sale a fully PMG approved**

### MIDLAND 1 WATT TRANSCEIVER

for 27,240KHz operation with switch provision for two additional channels, tone call signal, background noise squelch control, battery voltage indicator, steel case with separate cover, good for five miles distance communication under average field conditions, with penlite cell-batteries for

**ONLY $39.95 PER UNIT, FULLY GUARANTEED.**

### MAGNAVOX WIDE RANGE TWIN CONE SPEAKERS

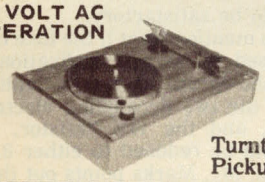
8 or 16 ohms VC. Post and Packing 65c.

6WR MK V 12 Watts RMS **$9.90**
8WR MK V 16 Watts RMS **$10.75**
10WR MK V 16 Watts RMS **$11.50**
12WR MK V 16 Watts RMS **$12.50**

**SPEAKER SPECIAL**
Imported Tesla 8" Speakers. 8 ohm imp. $4.75. Post and Packing 65c.

### NEW IMPORTED STEREO TURNTABLE AND PICK-UP

**240 VOLT AC OPERATION**

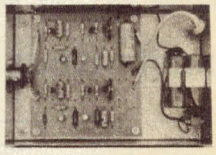


3 speed turntable with ceramic stereo pickup counter-balanced tubular arm, $7.90. Base in teak or walnut, $5.50 extra. De luxe base $8.50 Post 50c or $1.00 with base. .

Turntable and motor separate . . **$4.50**
Pickup arm and cartridge . . . . . **$3.50**

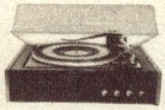
### A TRANSISTOR PREAMP FOR MAGNETIC PICKUP OR TAPE HEAD

Using 2 transistors per channel, as featured in "Electronics Australia" (Sept. 1971). Complete kit includes transistors, PC board, resistors, capacitors.
Circuit and full details supplied.
Kit (not incl. box) **$7.90**
240V Power Supply **$4.50**
Metal box **$2.00** extra.
State if required for pickup or tape head.



### NEW LOW COST STEREO SYSTEM

**AS FEATURED IN JAN. ELECTRONICS AUSTRALIA**

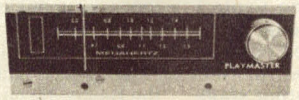


Complete kit of parts including "Garrard" record player with auto. stop and crystal pick-up. Magnavox 8WR or 6WR wide range twin coned speakers. (Cabinets not supplied). Amplifier only, less speakers and player. **$32.00**

**$69.50** Post and packing $2.50 extra.

### POLYESTER CAPACITORS

Pack of 100 new polyester capacitors .001 to 0.1 in 160, 250 and 400 volts working. **$3.50** Plus 50c Post and Packing



### BROADCAST TUNER KIT

**$22.50**
Post 75c.

Complete kit of parts including dial mechanism and zener diode for this I.C. tuner as featured in Feb. 71 E.A.

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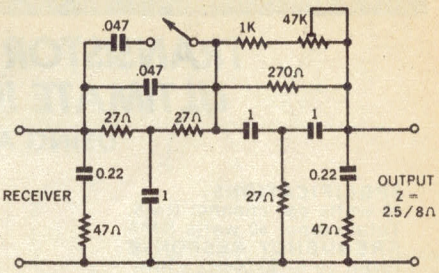
# NATIONAL RADIO SUPPLIES

**332 PARRAMATTA ROAD, STANMORE, NSW 2048 PHONE 56 7398**

## Speech Bandwidth Compression

Some research by K. Kryter, reported in QST December, 1960, in a letter from K3IQU, drew attention to the benefits that might result from the use in a receiver of three 500Hz filters rather than a single 2,700Hz filter; the proposed centre frequencies were 500, 1,500 and 2,500Hz. K3IQU strongly advocated that during alignment of crystal filters no attempt should be made to correct the double-humped response curve, leaving dips as pronounced as 30dB.

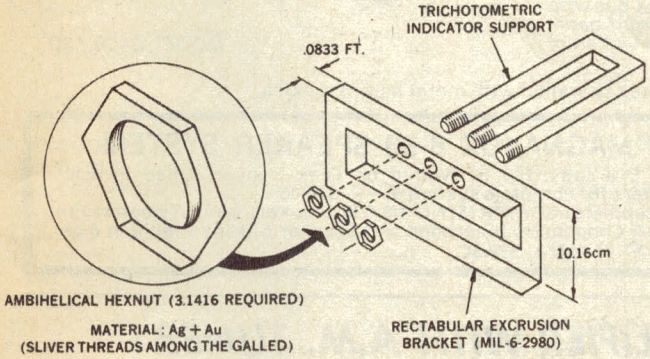
It appears from an article in Radio-REF(No 4 1971) that further research has been carried out in this area by NASA in preparation for Apollo communications. This team came also to the conclusion that only three portions of the speech band are really important: 300 to 400Hz and 2,500 to 3000Hz — plus (for a male voice) 900 to 1,700Hz or (for a female voice) 1,100 to 1,900Hz. The audio bands 400 to 900Hz and 1,900 to 2,500Hz seem to contribute little to intelligibility or even to voice identification. These bands can thus be suppressed to improve signal / noise ratio (in the case of Apollo it is suggested that these bands are used for biomedical telemetry).




Radio-REF reprints a NASA filter design shown herewith, which puts nulls at these frequencies and can be included in the low-impedance output (2.5 to 8 ohms) to phones or loudspeaker. P1 adjusts the null around 600Hz and the switch in the first section can be labelled "yl / om"!

(From "Radio Communication".)

## An Interesting Bracket Problem

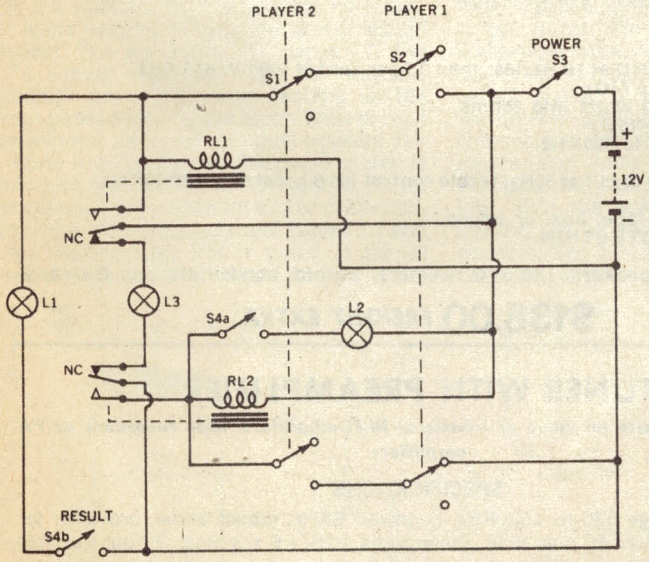



Inquiries concerning the mounting of the Trichotometric Indicator Support indicate that some difficulty is being experienced with the brackets which attach the support. As an aid toward fabricating the support brackets, the accompanying illustration is provided to show the type of material as well as the dimensional data needed.

It will be noted that in attaching the bracket to the support, a special ambihelical hexnut is used. The application of this nut is unique in that any attempt to remove it in the conventional manner only tightens it. Because of this design, the nut must be fully screwed on before it can be screwed off. (Courtesy NAA "Operations & Service News". From Approach, May 1965.)

(Editorial comment: It is fervently hoped that this vexing problem will be solved by this time next year.)

## Reaction Testing Game




*The unit is powered by a suitable 12V battery and the main components include two 12V relays, each with a set of changeover contacts. Switches include two DPDT toggle type and one each of DPST and SPST slider, etc. The lamps may be rated at 12V or 6V, with a suitable value of series dropping resistor.*

Here is a game which is a competition between two players. Construction is simple and straightforward. The three lamps and the "result" switch S4, are mounted on the front panel. The switch S3, for a third person is concealed and each player has a switch S1 or S2 in front of him.

The procedure is for the operator to close S3. Each player then attempts to be the first to operate his switch. Provided the difference in reflexes is greater than the relay pick-up time, then one will operate, extinguishing L3. On operation of the result switch S4, the lamp which is in parallel with the operative relay is lit, indicating the winner. If the players' reaction times are very close, the lamp L3 will remain on, indicating a draw.

(By Mr C. R. Whale, 33 Currawong Street, Young, NSW 2594.)

# TRANSISTOR STEREO AMPLIFIERS WITH IN-BUILT AM TUNER
## ULTIMATE IN DESIGN — LONG DEPENDABILITY
### USING ALL SILICON TRANSISTORS 40 WATTS — RMS

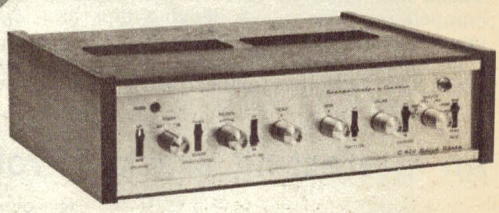
**SPECIFICATIONS:**
20 watts per channel RMS.
Total output 40 watts RMS.
**FREQUENCY RESPONSE:**
From 20 to 20,000Hz ± 1dB.
**HARMONIC DISTORTION:**
Less than 1 per cent of rated output.
**HUM AND NOISE:**
Aux 70dB, Mag 50dB.
**INPUT SENSITIVITY:**
Mag 3mV, Aux 200mV.
**SPEAKER IMPEDANCE:** 8 ohms.
**EQUALISED:** Mag RIAA.
**TONE CONTROLS:** Bass, 50Hz ± 12dB; Treble, 10KHz ± 12dB.
**LOUDNESS CONTROL:** 50Hz 10dB.
**SCRATCH FILTER:**
(High filter) at 10KHz 9dB.
**RUMBLE FILTER:**
(Low filter) at 50Hz 5dB.
**PROVISION FOR TAPE RECORDER:** Record or playback with DIN plug connection.
**PROVISION FOR HEADPHONES:** With headphone / speaker switch on front panel.
**DIMENSIONS:** 16½ x 5½ x 11in deep.
**TUNER:** This unit can be supplied with either valve or transistor tuner with a coverage of 530 to 1600 KHz. Calibrated dial available for all states.
**THE CIRCUIT** incorporates regulated power supply with transistor switching protection for output transistors. 26 silicon transistors plus 5 diodes are used.

**$134.00**
***PLUS FREIGHT***
**(CABINET EXTRA)**

**MODEL C300 / 20 / T**
(with Tuner)

**$108.00**
***PLUS FREIGHT***
**(CABINET EXTRA)**

**AMPLIFIER ONLY.** Specifications as above but with the added feature of front panel switch which allows selection of two speaker systems.



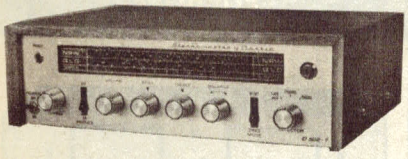
**MODEL C400 / 20**

Cabinets for above in teak or walnut with metal trim, $10 extra.

### THE NEW MAGNAVOX 8-30 SPEAKER SYSTEM

**Complete System** (1.6 cubic ft.) in Walnut or Teak Veneer, Oiled Finish. (regret no mail orders for complete system.) — — **$60.00**
**Speaker Kit** (less cabinets) COMPRISING 1-8 / 30 Speaker, 2-3TC Tweeters, 1-3in. Tube, 1-4 or 2uF Condenser, Innerbond and Speaker Silk Available in 8 or 15 ohms. Postage $1.50 extra. **$29.50.**

# NEW 6 WATT STEREO AMPLIFIER WITH A.M. TUNER



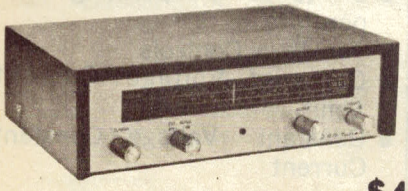
**$88.00**
***FREIGHT & PACKING EXTRA***
N.S.W. $1.75
Interstate $2.75.
Dimensions 12½" x 3½" x 9" deep

A high quality stereo amplifier incorporating the new Plessey SL403D I.C. audio amplifiers with separate bass and treble controls with inbuilt high gain A.M. tuner giving a coverage of 530 to 1600KHz with calibrated dial available for all States. Timber cabinet available in teak or walnut oiled finish.

**SPECIFICATIONS:**
**DISTORTION:**
Less than 1.5 per cent THD at 1KHz, less than 0.5 per cent at 100mW at 1KHz.
**SIGNAL TO NOISE RATIO:**
-62dB with respect to 3 watts into 8ohms.
**FREQUENCY RESPONSE:**
Within 2dB from 20Hz to 100KHz.
**TONE CONTROLS:**
Bass control 15dB boost or cut at 50Hz, treble control 14dB boost or cut at 10KHz.
**INPUT SENSITIVITY:**
250mV for all imputs, tape, aux. or phono.
**SHORT CIRCUIT PROTECTION.**

Above amplifier tuner supplies with two Magnavox 8WRMkV speakers, two 3TC tweeters, 2 4mfd. condensers and Garrard SRP22 record player with Sonatone ceramic cartridge.
Details of speaker cabinet with innerbond and speaker silk supplied. **$138.00** ***FREIGHT EXTRA***

## TRANSISTOR AM TUNER WITH PREAMPLIFIER



***Suitable for use with all valve or transistor HI-FI amplifiers, tape recorders or PA amplifiers***

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# Building Simple Receivers

**After reading the last chapter, no doubt many readers will want to try their hand at building simple radio receivers based on the concepts which they have met. The circuits presented here have been designed for just this purpose.**

Three basic simple receiver circuits, with variations, were described in Chapter 11. They were active detector, active detector with regeneration, and the latter with an audio amplifier stage.

In this chapter we shall describe simple receivers based on each of the circuits and discuss the level of performance to be expected from each. Figure 1 shows the first circuit, an active detector using an N-channel FET. This circuit is the same as figure 3 in the last chapter but component values have been added.

The active detection function is performed by an N-channel FET, the 2N5459 (formerly called the MPF105) from Motorola. The coil assembly is a time-honored "valve" type Reinartz coil, still made by Aegis Pty Ltd and designated type M.12. The tuning capacitor can be any tuning gang with a maximum capacitance of about 400pF.

Our photograph shows a nine-volt battery but the circuit will give better performance with a 12 volt battery. Note however, that voltages over 12V should not be used otherwise the FET may be damaged. An old 12V car battery may be used to power the circuit, if one is on hand. One can really raid the junk box for a project like this.

There is no need for a metal chassis. Ours was made from a piece of particle-board and tempered hardboard (Masonite or Burnieboard) for the front panel. Wiring layout is not critical but novice readers should follow our wiring diagram of figure 2 to avoid mistakes. Cross check it with the circuit diagram, figure 1. At any rate, keep all wires as short as possible, consistent with neatness.

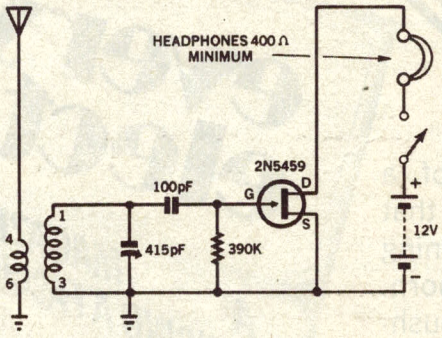



*Figure 1: One FET and a handful of components make up the simple active detector circuit.*

The Reinartz coil was mounted on the board with the aid of an electrolytic capacitor mounting clamp, but there is no reason why it must be mounted in this attitude. It may be mounted on its side, if convenience dictates. Just don't let it float around. When making connections to the coil, take care not to overheat the coil terminals otherwise the plastic former will be melted.

If you use a tuning gang salvaged from an old radio set, make sure it is clean and that the moveable plates are not shorting to the fixed section. This can be easily checked with the aid of a multimeter switched to the "ohms" range.

If you are going to make a dial for the set remember that stations at the low frequency end of the broadcast band are received when the tuning gang capacitance is relatively high, i.e., when the plates are meshed together.

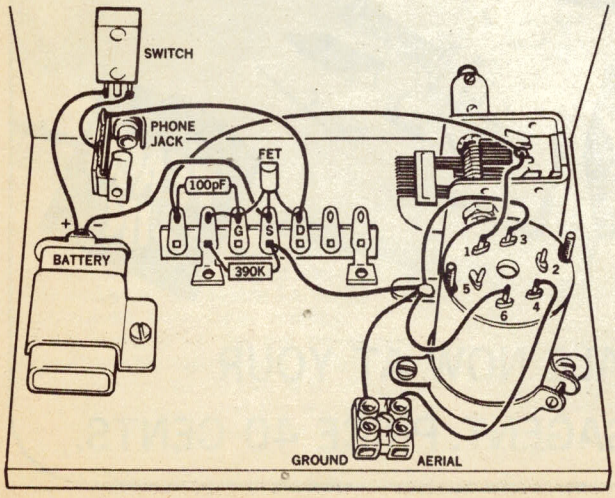
The FET and its gate components, 390K resistor and 100pF capacitor, can be mounted on a tagstrip as shown in the diagram. If you wish, it is not necessary to install an on / off switch for this circuit — disconnecting the phones from the jack socket effectively disconnects the battery.

Again, take care not to overheat components when soldering. This applies particularly to transistors and polystyrene capacitors. It is wise to tin the leads and to use a crocodile clip or a pair of long-nosed pliers as a "heatsink", if you are a novice at soldering. The idea is to use the clip or pliers to grip the component lead between the solder joint and the body, so that most of the heat is conducted away from the lead before it has a chance to heat up the component itself and cause possible damage.

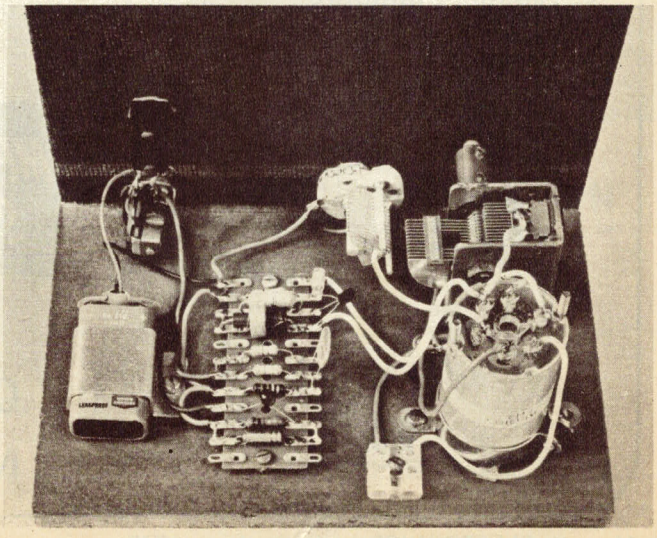
The headphones should be "medium" to "high impedance" — i.e., they should have a nominal impedance of at least 400 ohms and preferably higher.

An insulated terminal block is mounted on the board for connection of earth and aerial wires. Strictly speaking, the earth con-

*Figure 2: Below is the wiring layout for the active detector circuit of figure 1. Follow the diagram carefully to ensure correct connections.*




*Below is shown the prototype receiver complete with regeneration and a voltage amplifier stage. The wiring diagram for the complete receiver is shown in figure 6.*



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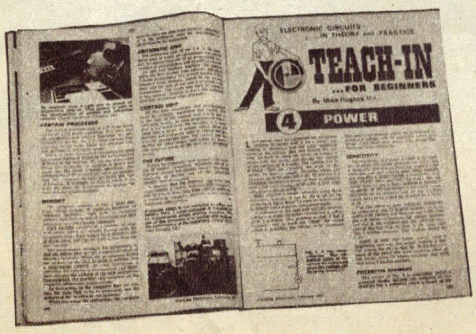



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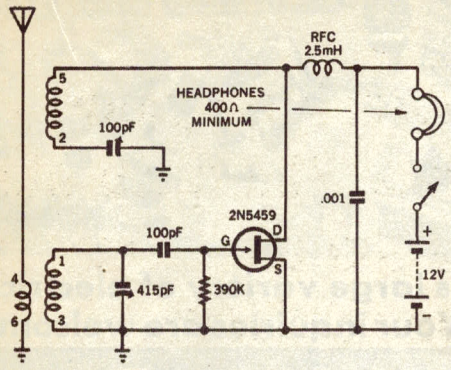


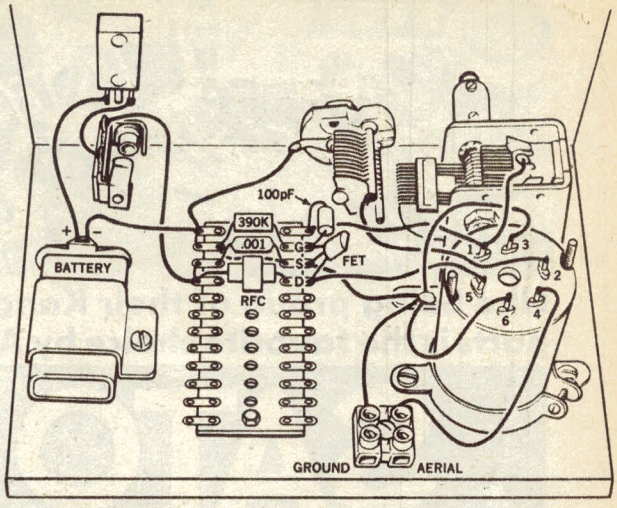




*Figure 3, above, is the circuit for the active detector with regeneration while at right, figure 4, is the wiring diagram. Note the extra components compared with figure 2. For those wishing to wind their own Reinartz coil, winding details are given on the following page.*

nection should be made to a water pipe or a metal plate buried in the ground.

For best performance, the aerial wire should be as long and as high above ground level as possible. But many readers in the metropolitan areas may obtain adequate performance with just a few feet of wire.

Having checked all connections for errors, you are ready to apply power (connect the battery) and put on your headphones. As readers will remember from Chapter 11, the FET operates without bias when no signal is applied to the gate. This means that the current drain is relatively high at around 10 milliamps, depending on the impedance of the headphones.

When signal is applied to the FET gate, the FET develops a negative gate bias which is proportional to the peak value of the RF input signal. The mechanism by which this happens is fully discussed in Chapter 11. The effect of the negative gate bias is to reduce the current drain, although with this circuit unless the stations tuned are particularly strong, any reduction is likely to be minimal.

With this basic receiver you should be able to tune several radio stations, but this will depend very much on the area in which you live — whether or not it is a strong signal area, and on the parameters of the particular FET used.

Having determined the level of performance available from the simple active detector circuit, you are now ready to add components for regeneration. The circuit is shown in figure 3. The additional components are a 100pF variable capacitor for controlling the level of regeneration, a 2.5mH RF choke and a .001uF capacitor. This is the same as figure 4 of Chapter 11.

Again, we have provided a wiring diagram to facilitate connections — see figure 4. Pins 2 and 5 of the Reinartz coil are now connected into circuit. The FET and its associated components are mounted on a short length of tagboard. Leave sufficient terminals available to add the audio stage to be described in the next step.

The reaction or regeneration capacitor we used is a small variable air dielectric type as used in transmitters but there is no reason why other types could not be used. One could, for example, use a smaller capacitance tuning gang or even a mica "compression" trimmer for the basis of the experiment.

Having connected the regeneration components, apply power to the circuit again and don your headphones. With the regeneration capacitor set for minimum capacitance, i.e., with capacitor plates unmeshed, the circuit behaves very similarly to the active circuit tried previously.

Increasing the capacitance of the regeneration capacitor increases the loudness of the signal but also causes the signal to become distorted. This is because the loading effect of the regeneration coil and capacitor causes detuning of the main resonant circuit. Consequently the tuning and regeneration controls interact and have to be adjusted in conjunction with each other.

As the regeneration control is advanced, the FET drain current is reduced markedly. This is because the regeneration acts to feed much stronger signals to the gate of the FET and consequently develop more negative gate bias.

If the regeneration control is wound up too high, the circuit will go into oscillation. This will be evident in a number of ways. First, if the circuit goes into oscillation while it is being tuned to a station, the oscillation will be evident as a violent squeal. This is the heterodyne or difference frequency between the broadcast station's carrier frequency and the resonant frequency of the tuned circuit.

The reader may query this statement: If the circuit is tuned to the broadcast station, why should there be a difference between the incoming carrier frequency and the resonant frequency of the tuned circuit? This can be answered in a number of ways. First, the tuning gang does not have to be tuned exactly to the station's carrier frequency in order to hear signals — it can be considerably away from it, if the signal is strong enough.

Another partial answer is the detuning effect of the regeneration control. You can easily show this, once the circuit has begun squealing, although you'll need to take the headphones off. Try varying the regeneration control — notice its effect on the pitch of the heterodyne whistle.

If the circuit goes into oscillation between stations it will be noticeable as a single click from the headphones. The click is caused by the abrupt drop in FET drain current as the circuit goes into oscillation. This can be checked with a multimeter switched to a low current range. It can also be verified with the aid of a transistor radio, or any other radio for that matter.

You will be able to tune the radio to the resonant frequency of the circuit as it is radiated from the aerial. As you do so you will hear the familiar heterodyne whistle between the radiated frequency and the frequency of the local oscillator of the radio. Instead of being a sensitive regenerative receiver, the circuit is now a low power transmitter with an unmodulated carrier!

But this is hardly the purpose of building

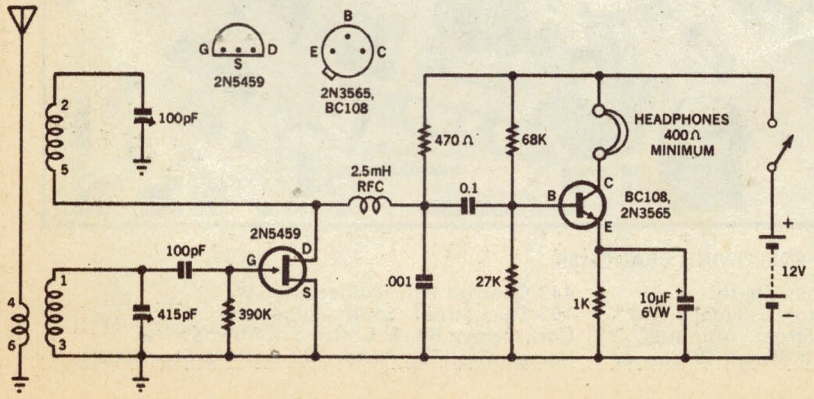
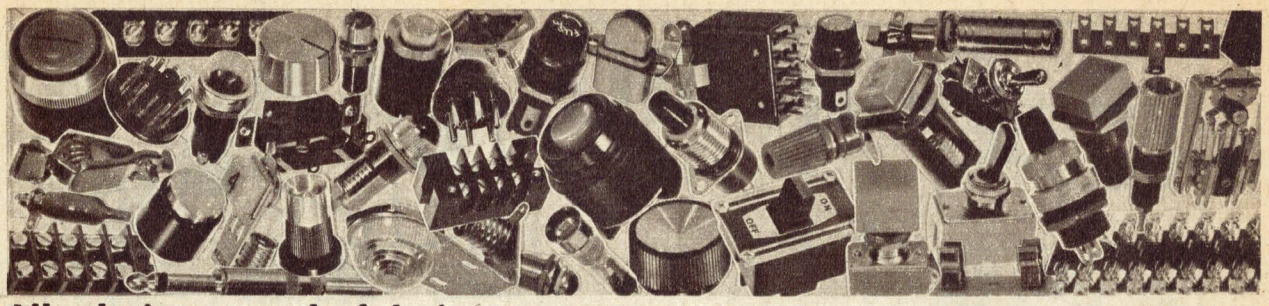



*Figure 5, at left, is the final circuit, with an AF voltage amplifier stage to drive the headphones.*



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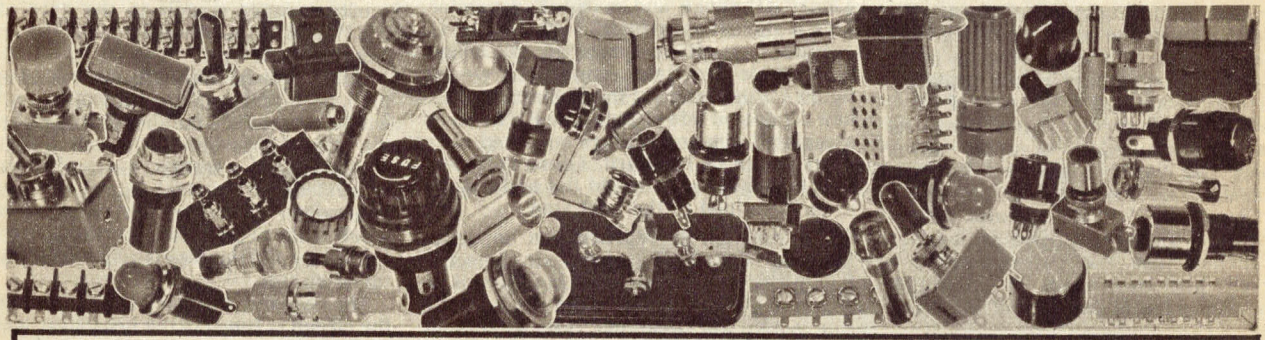

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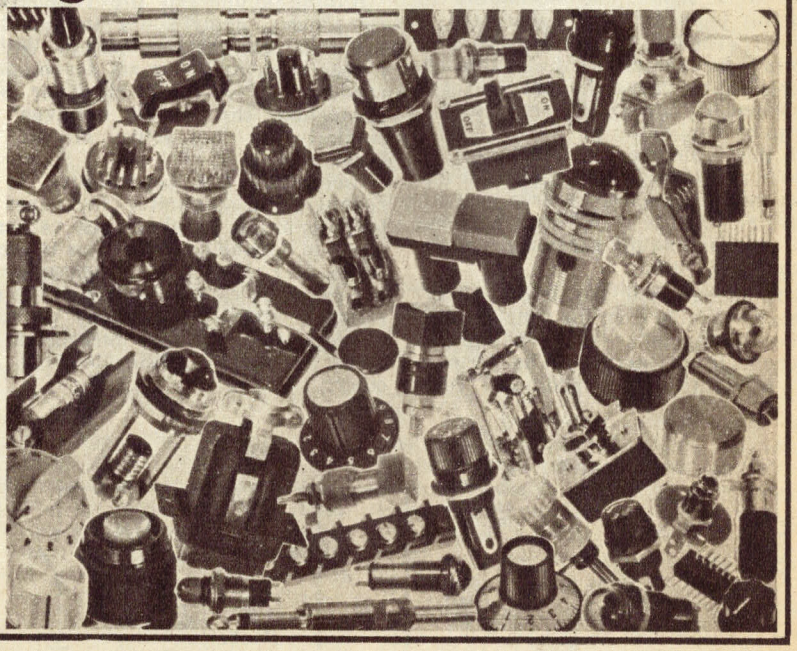

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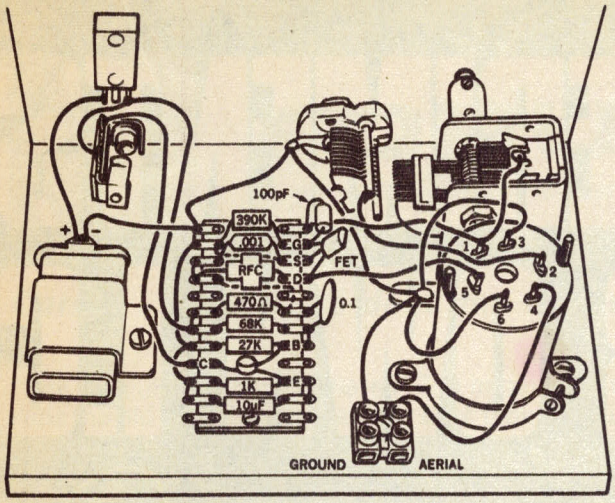



*Figure 6, left, is the complete wiring diagram for the circuit in figure 5.*

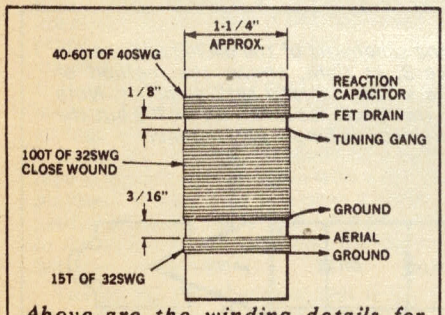
the receiver. We mention it as part of the discussion of its behaviour and to point out that an incorrectly used regenerative receiver can be a source of interference to radio communications.

The essential purpose of building these circuits is for the reader to discover the high degree of performance that can be obtained, with patience, from what is basically a very simple receiver.

The performance of the receiver of figure 3 can be further increased by the addition of an audio stage to drive the headphones. The additional gain renders the receiver somewhat easier to use — the regeneration control does not have to be advanced so far to make stations listenable and consequently there is less likelihood of the FET detector breaking into oscillation.

Figure 5 shows the additional components for the audio stage. This is the unit shown in the photographs. In this circuit, the 470 ohm resistor becomes the audio frequency load for the FET and the signals developed across it are fed to the audio stage via a 0.1uF capacitor. No volume control is fitted to the circuit. One can use the regeneration control for this purpose, although admittedly, it is not ideal. We have omitted a volume control because it introduces a loss in gain.

The circuit is built along the same lines as the other two, with most of the smaller components mounted on a 12-lug length of miniature tagboard (see figure 6). This should be completely wired as an assembly and then mounted on the board. As before, components salvaged from old radios may be used here but they should be checked before installation.




*Above are the winding details for those who wish to make their own Reinartz coil. Use a cardboard or plastic former.*

Resistors can be checked with a multimeter switched to the ohms range for correctness of value, and capacitors can be similarly checked for insulation resistance. It would be wise, though, to use a new electrolytic capacitor for the bypassing of the emitter resistor of the audio stage, because electrolytic capacitors deteriorate quite markedly with age.

The additional transistor is a general purpose silicon NPN bipolar type. Do not substitute other transistors unless you are sure they are directly equivalent.

The prototype receiver was tried out in the Western suburbs of Sydney, which is a strong signal area. With just a few feet of aerial, all the local broadcast stations romped in, plus a few country stations and Radio VL2UV, the University of NSW broadcast station on 1750KHz. With a longer aerial, it should do equally well in rural areas.

*PARTS LIST FOR REGENERATIVE RECEIVER*

*1 Chassis and panel to suit components.*
*1 12V battery and connections to suit.*
*1 Reinartz coil, Aegis type M12 or similar.*
*1 Tuning capacitor, 415pF (see text).*
*1 100pF variable capacitor for regeneration (see text).*
*1 2N5459 field effect transistor (FET).*
*1 BC108, 2N3565 or similar silicon transistor.*
*1 phone jack.*
*1 pair of headphones; minimum impedance 400 ohms.*
*1 on/off switch.*
*1 12-lug length of miniature tagboard.*
*1 2-way insulated terminal block.*

*RESISTORS*

*(½ or ¼ watt rating).*
*1 x 390K, 1 x 68K, 1 x 27K, 1 x 1K, 1 x 470 ohms.*

*CAPACITORS*

*1 x 10uF/6VW electrolytic,*
*1 x 0.1uF/25VW ceramic, polyester or paper,*
*1 x .001uF/100VW ceramic, polyester or polystyrene,*
*1 x 100pF/100VW ceramic or polystyrene.*

*MISCELLANEOUS*

*2 Knobs, screws, nuts, wire, solder, battery clamp.*

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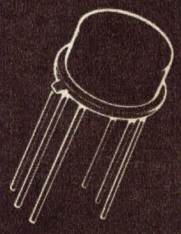


**by LEO SIMPSON**

The IC which we have chosen as the basis for this article is the Fairchild uA703, a silicon monolithic device which although designed especially for use as an RF amplifier and limiter, can also be used for a variety of other purposes. The word "monolithic" simply means that all of the circuitry in the device is fabricated as part of a single tiny chip of silicon.

You can perhaps appreciate what this involves by looking at figure 1, which shows the uA703's internal circuit. The five transistors and two resistors all consist of combinations of microscopic P-type and N-type regions within the same tiny chip of silicon, measuring only a tenth of an inch or so square. The connections between these regions of the chip are formed by a tiny pattern of aluminium film deposited on the surface of the chip. Finally the chip is mounted in a metal can similar to a normal transistor, to produce the final IC.

Readers can obtain their introductory uA 703 device at the special low price of 75 cents (NZ readers $1.00), by courtesy of Fairchild Australia Pty Ltd. But the device can only be obtained at this low price by filling in the special offer coupon provided in this article, and posting it to Fairchild's office in Victoria at PO Box 151, Croydon 3136. Please note that the device cannot be obtained from "Electronics Australia" offices, and that Fairchild Australia Pty Ltd will not be able to enter into any technical correspondence regarding the device.

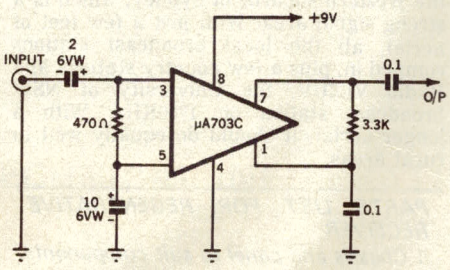
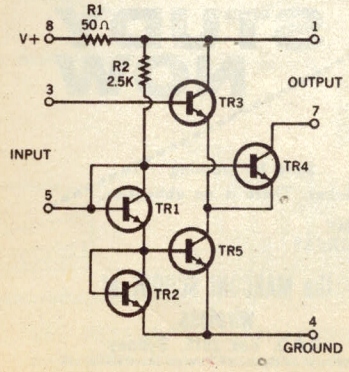



*Figure 2. An AF amplifier stage.*

Basically, the amplifier circuit configuration used in the uA703 is that of a current-limiting long-tailed pair. Tr5 is essentially a constant current source which provides the 'tail' current to the amplifier transistors Tr3 and Tr4. R1, Tr1 and Tr2 provide the bias voltages for Tr5 and also for Tr3 and Tr4. No external biasing components are necessary. R1 is for decoupling of the supply. Note that transistors Tr1 and Tr2 are shorted from collector to base, so that they actually function as forward-biased diodes.

Under small signal conditions, the uA703 can be considered as an emitter-follower (Tr3) driving a grounded base amplifier (Tr4). Input impedance is low and output impedance is high which is ideal as far as high-Q output tuned circuits are concerned. Normally the input signal is applied from a transformer winding to pins 3 and 5.

Under large signal conditions, where the input signal is greater than about 300mV peak-to-peak, the circuit operates by switching the "tail" current into Tr3 or Tr4, depending on which has the more positive base potential. This means that the collector currents of Tr3 and Tr4 are square



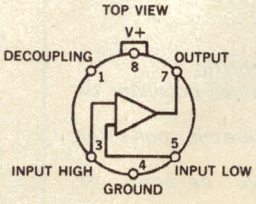
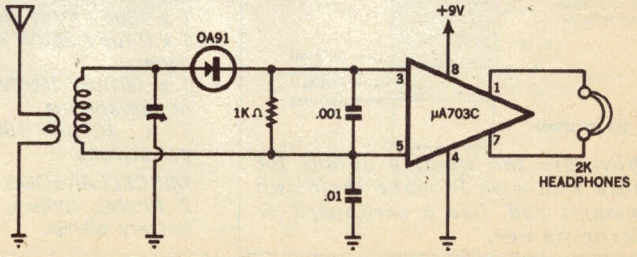




*Figure 1, at left, shows the schematic of the uA703 and the pin connections while figure 3, at right, shows the method of connection to use it as a simple "crystal set" amplifier. Note that the type number on the IC will not simply be uA703 but the numerals 703 will be contained in a longer part number.*



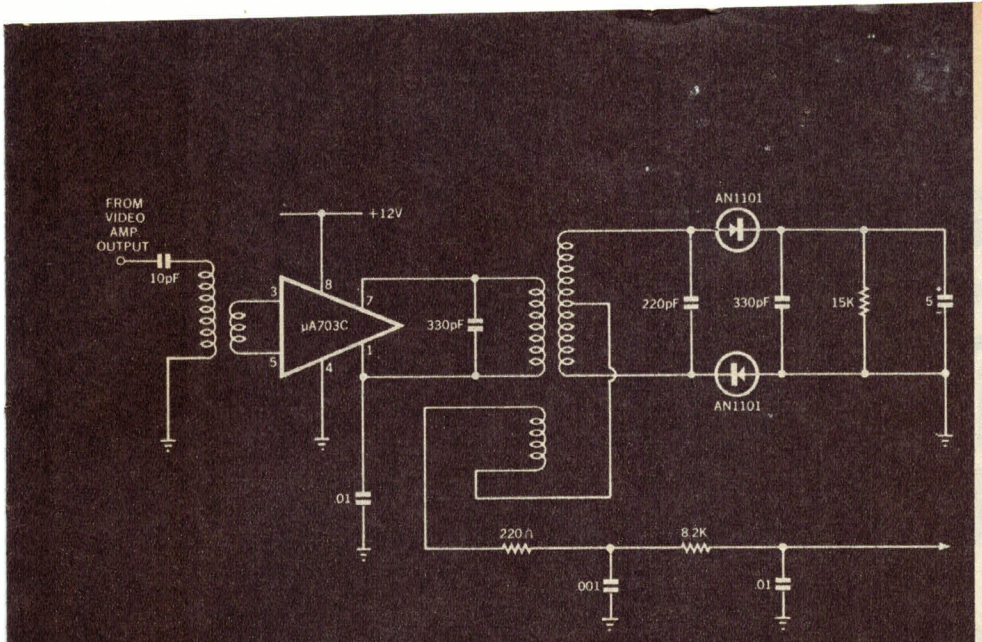



*Figure 4. This circuit shows the primary use of the uA703, as a limiting amplifier combined with a ratio detector, in FM sound systems.*

waves which are 180° out of phase with each other. A parallel-tuned circuit across the ouput terminals (pins 1 and 7) rejects the harmonics of the square wave and produces a sine wave at the output.

As can be imagined, under large signal conditions, the circuit thus has excellent limiting characteristics, making it ideal for use in IF amplifiers for FM sound systems. Under small signal conditions, the device acts like a normal linear amplifier.

While the uA703 is intended for use mainly at radio frequencies up to 100MHz, there is no reason why it cannot be used at audio frequencies, although the special biasing arrangements do make things a little tricky. Figure 2 shows how the uA703 can be used as an audio amplifier, for small signals.

Instead of coupling the signal into the input with a transformer winding, a 470 ohm resistor is connected between pins 3 and 5. Pin 5 is grounded with respect to AC signals by the 10uF capacitor and the input signal is capacitively coupled into pin 3. A similar approach is used at the output with the signal being developed across a 3.3K resistor and capacitively coupled to the output.

The resistor values shown are a compromise. Lower values at the input result in too low an input impedance while higher values increase the current drain. At the output the resistor value must be low enough to ensure correct operation of Tr4 but not low enough to cause undue loading and resultant distortion.

The voltage gain of this circuit is typically about 30, and while the low input impedance is a little restrictive, there are a number of applications to which such a circuit can be put. One suggestion is as a low impedance microphone preamplifier; the reader will no doubt think of many others.

Maximum output voltage is 1V RMS. Attempts to obtain more output voltage will merely drive the circuit into the switching mode described earlier.

Figure 3 shows basically the same configuration used as an audio stage in a so-called "crystal" set using a germanium diode. The .001uF capacitor across the 1K input resistor shunts detected RF signals to ground via the 10uF capacitor. The amplifier load is provided by a pair of 2K dynamic headphones. Lower values should not be used.

It is probably true that equal or better performance could be obtained from a single common-emitter transistor in the audio stage. However the circuits presented here are mainly an exercise in ingenuity — how many circuit functions can be performed by what is basically a specialised RF device? Any reader who buys the device will no doubt want to experiment with it in as many applications as possible, just for interest's sake.

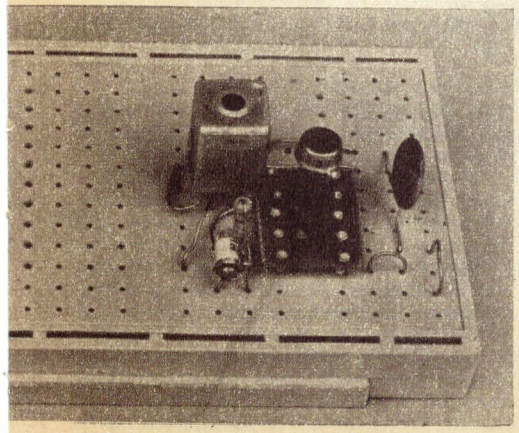


*Figure 6, at right, shows the uA703 used in a simple LC oscillator at 3MHz. At left is the prototype oscillator mounted on a Microdec breadboarding panel which was reviewed in last month's issue.*

Figure 4 shows the major use of the uA703, as the manufacturer originally intended: as a limiting IF amplifier followed by a radio detector. As such, it will perhaps be of only passing interest to most readers since their only access to FM sound is via television. Because of this, we have not tried the uA703 in such a circuit and cannot supply coil details.

Another "different" use for the uA703 is shown in figure 5. This may look very similar to figures 2 and 3, but in fact it works quite differently. Here, the circuit operates as an oscillator in the switching mode, rather like a multivibrator. Pin 7 is coupled back to pin 3 via a 10K resistor and .047uF capacitor. This RC network is alternately charged in one direction and then the other as Tr4 and Tr3 switch on and off. The output wave form at pin 7 is a square wave at a rate of 1KHz.

Current drain of this square wave oscillator circuit is 0.5mA at a voltage of 9V. As such, the unit makes a handy signal injector. The repetition rate or frequency can be changed merely by varying the size of the capacitor between pin 7 and 3. Increasing it decreases the frequency, and vice versa.

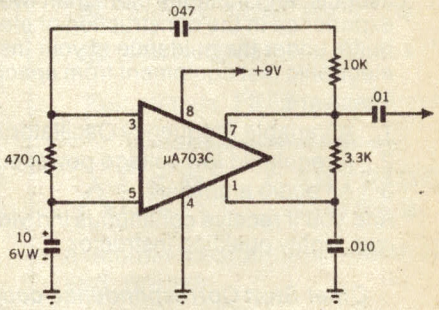
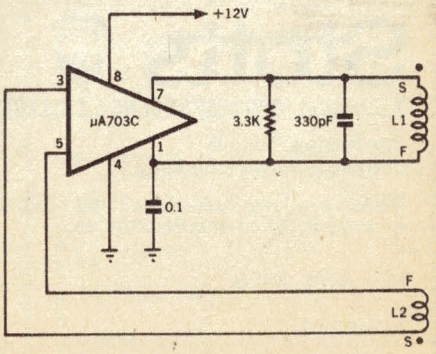



*Figure 5, above, shows the uA703 in an AF oscillator circuit which has square wave output at 1KHz.*

The uA703 also functions very well as an RF oscillator. Figure 6 shows the circuit for a remarkably simple LC oscillator requiring only four components in addition to the uA703.

Inductor L1 and the 330pF capacitor form the tank circuit. L2 is coupled very tightly to L1 so that sufficient of the output signal is fed back to the input (i.e., positive feedback) to ensure switching action of Tr3 and Tr4 as described earlier. As with limiting




L1 : 28T, 30 B & S ON NEOSID SMS TYPE "A" ASSEMBLY WITH GRADE 900 SLUG, CUP AND RING.

L2 : 6T, 30 B & S.

# IC experiments

amplifier operation the current waveform applied to the parallel-tuned tank circuit is a square wave. The resonant circuit provides a sinusoidal voltage waveform at the output whose amplitude is greater than the value for the supply voltage.

With a 12V supply the sinusoidal waveform has a value of 15 volts peak-to-peak. The output can be coupled via a further winding on the L1 / L2 transformer, or capacitively coupled from pin 7. The tank circuit shown has been chosen for an oscillator frequency of 3MHz.

The tuned transformer is wound on a miniature Neosid coil former assembly, designated SMS type A. This uses a ferrite cup and ring assembly to couple the windings together, along with a grade 900 slug.

Handwinding these miniature coil assemblies is tricky, to say the least. Use 30B&S, or thinner, enamelled or cotton-covered copper wire. First, glue the former to the bakelite base. Then slip the ring assembly on to the former. The primary, L1, can then be wound and terminated (28 turns). It must be neatly layerwound (this is the tricky bit) so that the ferrite cup assembly fits neatly over the ring. After the primary is finished, the secondary is wound directly over it and the ferrite cup pushed over the whole winding and ferrite ring. It can be held in place with a spot of glue.

The starts and finishes of both windings should be marked on the coil assembly base. If the windings are not correctly phased the oscillator will not function.

The uA703 also works well as a crystal controlled oscillator as shown in figure 7. This has been tried with a variety of crystals and found to be quite reliable. The load capacitively coupled to pin 7 should be

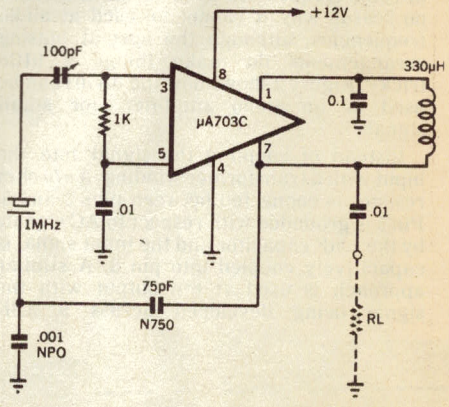



*Figure 7 shows the uA703 in a crystal oscillator circuit at 1MHz. The tank circuit may be modified for other frequencies.*

less than 2.7K for correct switching operation of Tr4. The output voltage with this load is 7V peak-to-peak.

The final use presented for the uA703 is as an RF amplifier. The basic circuit is shown in figure 8. The input is tuned and the output is taken from across a fixed RF choke of 2.5mH. The coil details are taken from those used in the transistorised RF preamplifier featured in May 1969. This ranges up to 30MHz. While the uA703 will function up to

## COIL DETAILS

| | |
|---|---|
| 1.5MHz-3.0MHz | Secondary, 50 turns 26 SWG enamel, wound to occupy about 90 per cent of former. Primary, 5 turns, interwound at earth end of secondary. |
| 3MHz-6MHz | Secondary, 24 turns 24 SWG enamel, wound to occupy about 60 per cent of former. Primary, 3 turns, interwound at earth end of secondary. |
| 6MHz-15MHz | Secondary, 9 turns 18B&S enamel, wound to occupy about 50 per cent of former. Primary, 2 turns 26 SWG enamel, interwound at earth end of secondary. |
| 15MHz-30MHz | Secondary, 4 turns 18B&S enamel, wound to occupy about 33 per cent of former. Primary, 1 turn 26 SWG enamel, interwound at earth end of secondary. |

Each coil uses a toroidal former, Ducon type F4040/2, Q2 material.

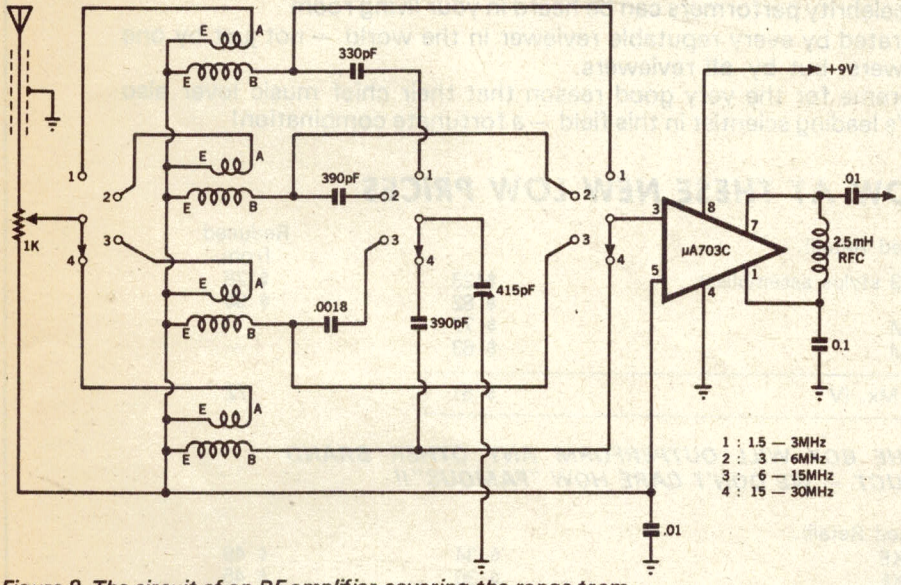



*Figure 8. The circuit of an RF amplifier covering the range from 1.5 to 30MHz. The coil details are shown immediately above.*

100MHz, the performance is reduced above 30MHz. The coils are wound on toroids which has the effect of minimising isolation problems. The toroids can simply be mounted on tagboard, with wires running off to the double-pole switch.

Finally, a word or two about construction techniques. Perhaps the easiest way of making connections to the IC is to mount it on a short section of miniature tagboard. All wiring, especially earth returns, should be kept as short as possible. It may be necessary, in some cases, to use a "ground-plane" technique, with all earth connections made to a chassis of tinplate or brass.

A more elegant, though expensive method for experimental mockups is to use a breadboarding kit such as "Microdec" nodeboard. An accompanying photograph shows the LC oscillator mocked up on this kit. This approach will perhaps appeal more to teaching institutions, where demonstrations must be quickly and neatly wired up and also easily dis-assembled.

Well, there you have it. A number of interesting and easily built-up circuits which will let you experiment with the uA703 device and thereby gain valuable practical experience with modern linear IC's. No doubt a few more applications will have suggested themselves to you as you have been reading this article, so take your confidence in both hands and try them out too. There is little to lose, and plenty to gain!



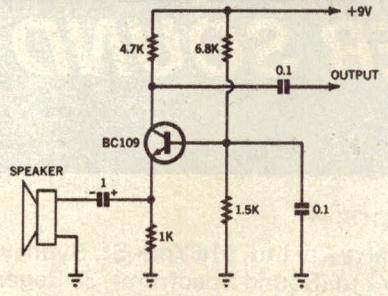
# Elementary Electronics: Ideas Worth Trying

## USING A SPEAKER AS A MICROPHONE

It is not generally realised that a permanent magnet, moving coil loudspeaker can be used as a microphone. In fact, because of their large cone area, "permag" speakers (as these type are called) are quite sensitive.

The sensitivity of the speaker when used as a microphone is proportional to the cone area. This means that, as the speaker becomes larger, it will become more sensitive. Despite this, even the small speakers which are used in portable transistor radios are quite sensitive, compared with many common microphones.

The usual order of speaker impedance is eight to fifteen ohms. Some go as low as two ohms — others to thirty or more. The output voltage is proportional to the impedance, so that a high impedance speaker will give a higher output voltage than a low impedance type.




However, even a high impedance speaker is unlikely to have enough output voltage to drive a normal preamplifier fully. One way to overcome this is to use a small speaker transformer "back to front". This may be one salvaged from an old transistor radio. The step up in turns ratio gives a corresponding increase in voltage.

Another approach would be to use the simple "grounded base" preamplifier stage which we have shown above.

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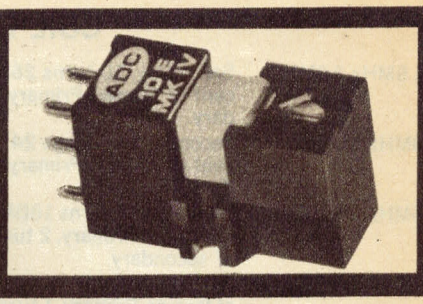


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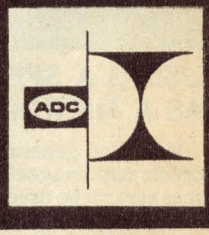


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# CLASSICAL RECORDINGS

Reviewed by Julian Russell

## *Parsifal — absorbing and often moving*

**WAGNER — Parsifal. Complete opera. James King (Parsifal); Gwynneth Jones (Kundry); Franz Crass (Gurmenanz); Thomas Stewart (Amfortas); Donald McIntyre (Klingsor); Karl Ridderbusch (Titurel). Chorus and Orchestra of the Bayreuth Festival conducted by Pierre Boulez. DGG Stereo 2730 034. (Five Discs).**

Pierre Boulez has been conducting Parsifal regularly at Bayreuth since the death of Hans Knappertsbuch, the previous incumbent. For this he has received much more than moderate praise, a great achievement for a Frenchman in such a stronghold of German music. But to understand Boulez' controversial interpretation in this set it is helpful to read his very sagacious essay, "Approaches to Wagner," which appears in the brochure and libretto (English and German) that accompanies the set of five records, as handsome a brochure as I have ever seen. In the first place Boulez doesn't sermonise in his reading of the work, a temptation that overcomes many other Parsifal conductors. Rightly or wrongly, according to your personal acceptance or rejection of Faith, he is never awed by anything but the score and its accompanying drama.

Despite many claims and perhaps indications to the contrary, Wagner was in no way a Christian. He was a pagan, or perhaps even a pantheist. On one occasion before the bitter quarrel that separated them for the rest of their lives, Wagner remarked to the German philospher Nietzche: "These Germans don't appreciate or want works about gods and goddesses. One of these days I'll write one about Jesus Christ." Nietzsche, the anti-Christian, looked at him in horror and never spoke to him again.

Perhaps the key to Boulez' interpretation is contained in these words, which appear in his essay: "It seems to me that Wagner in his musical gestures (in Parsifal) is never emphatic, not grandiloquent, it seems to me that genuine grandeur can do without exaggerated demonstrative parody . . . In Parsifal more than in any opera the romanticism is within." And he goes on to an even more profound remark: "For the believer there is something more beautiful than Parsifal; an ordinary Mass in any church."

Elsewhere in his essay Boulez analyses the many origins of the Parsifal legend and the legend of the Holy Grail, all of which are secular. In his performance Boulez clears away some of the fog of mysticism that has always clouded the work. It has French clarity, and I suspect, Cartesian scepticism. What he offers is pure theatre, never overdone, but always preserving Wagner's quasi reverence.

Since I could go on in this vein through all the space allotted me for these reviews I had better, without further delay, get to the performance itself and I must start by saying that while I found much of it of absorbing interest and often profoundly moving I suffered disappointments, too. The whole of the first act is superb, with one exception — the Gurmenanz, sung by Franz Crass. To me that part is always something of a bore, a blown-up King Mark moralising at tiresome length. Crass, despite a good voice and careful attention to all the mechanics of its production, achieves a quite Olympian dullness. Even the splendid resonance in his upper register fails to imbue the role with vitality. But in Act 1 that was my only disappointment. And against it note the restrained excitement that follows the shooting of the swan and Parsifal's first entrance. Then there is the Transformation Music, its "bell" theme unemphasised until transferred magically to the timpani. In fact, despite DGG's characteristic favouring of the voice at the expense of the orchestral part the fine Bayreuth orchestra can be heard in great form, always playing with the utmost sensibility.

James King is a splendid Parsifal both vocally and in his charactersation. His innocent bewilderment at what is happening to and around him is a masterly exercise. I enjoyed too the wildness of Gwynneth Jones' Kundry, even in its occasional unsteadiness and almost raw delivery that somehow suits the part in this act. The chorus of the Knights of the Grail is well sung but this part of the work always strikes me as its least interesting. The Amfortas of Thomas projects just the right agony that the composer intended — anguish that goes far to rise above self-pity. This act may not be everyone's Parsifal, especially Boulez' contribution, but a great deal of it is certainly mine.

I was less moved by Act 2. During the rehearsal and recording sessions many of the cast suffered a virus affliction that made postponements and hurried takes necessary, a shortcoming most noticeable in Miss Jones' Kundry. In this act she must switch from uneasy savagery to voluptuousness and quite frankly, such is her lack of sensuality that Parsifal's rejection of her advances seems less due to his strength of character than to her absence of femininity. But there are no overdone histrionics in Boulez' Prelude to the act and his treatment of the whole is validly dramatic.

Klingsor, always a little reminiscent of a demon king in pantomime, does well though some of his longer phrases show shortness of breath. Boulez' playing of the Flower Maidens' music is a delight, though I would have liked to hear more of the beautiful triplet figure on muted violins that accompanies their entrance. And in this act Kundry's failure seems to inhibit even the excellence of Parsifal's response.

Welcome, too, would have been more of the orchestral part here and there in the Good Friday Music of Act 3 but otherwise I listened to it with uninterrupted delight. Boulez' second Transformation Music is truly terrific, reaching ever upwards but always falling back in despair. These are some of the greatest bars Wagner ever wrote. The chorus of Knights at Titurel's funeral and their fierce demand for the uncovering of the Grail are realised to the full. And the chorus in the dome is even better than that same part in Act 1.

Although this recording was made from tapes of live performances the perfect behaviour of the Bayreuth Festspiel audience never intrudes on to a disc. To enter or leave the hall during a Bayreuth performance is unheard of and anyone trying it on would probably court a swipe from Wotan's spear. Coughs and sneezes are inhibited whatever the discomfort to the would-be cougher or sneezer.

Whether you will prefer this recording to the 1964 Knappertsbusch (Philips) set will be a strictly personal choice. I myself will in future plays Boulez' Acts 1 and 3 and Knappertsbusch's Act 2 and so avoid the quite serious let-down of Gwynneth Jones in Boulez' Act 2.

★ ★ ★

**BEETHOVEN — Two Romances for Violin and Orchestra.**
**MOZART — Adagio in E Major (K.261) and Rondo in C Major (K.373).**
**SCHUBERT — Rondo in A Major. (D.438). Josef Suk (violin) and the Academy of St. Martin-in-the-Fields conducted by Neville Marriner. HMV Stereo OASD2725.**

This is an enjoyable recital of small but by no means trivial pieces. Suk has a sweet, refined tone and an unerring feeling for just where the cusp of a phrase lies. He begins with the Mozart Rondo in which he displays a deceptive modesty. He makes it sound very easy indeed, which, of course, it most certainly is not. He next brackets the two Beethoven Romances which demand — and receive — a broader style. In his sleeve notes W. A. Chislett observes with considerable sagacity that "so far as the solo parts are concerned they might be the middle movements of lightweight concertos but the orchestra is not a full concerto partner, having no more than an accompanying role." This treatment is scrupulously observed by Marriner and his first class chamber ensemble.

In these Beethoven pieces Suk has many formidable competitors. The Romances are in almost every concert violinist's repertoire, but that does not prevent me from thinking that Suk's are my favourite version of them. And the orchestra's contribution is of matching eloquence of the no nonsense kind. Here is pure music making just for the joy of it. Again, in Mozart's lightly scored Adagio, Marriner's group is just as perfect — a fact revealed by the life-like quality of the recording. Above this Suk lofts a typically Mozartian cantilena for solo violin with delicious clarity that avoids any hint of sentimentality.

From its title those unfamiliar with Schubert's music might well think his

Rondo in A to be merely a delectable addition to this charming recital. It is, in fact, the longest piece on this disc and is full of lovely Schubertian melodies. After an Adagio introduction it passes without pause into an allegro giusto — a puzzling phrase that can mean either "strict time" or "suitable time." Suk chooses the latter meaning and he and Marriner bring off the whole beguiling work with effortless beauty of tone and phrase. Very strongly recommended for those in search of musical relaxation.

★ ★ ★

**SHOSTAKOVITCH — Piano Concerto No. 2. OGDON — Piano Concerto No. 1. John Ogdon (pianist) with the Royal Philharmonic Orchestra conducted by Lawrence Foster. HMV Stereo ASD2709.**

Although Shostakovitch started life as a virtuoso pianist he has composed little keyboard music for solo instrument. The piano sometimes figures prominently as a colourful addition to purely orchestral works — the first Symphony comes immediately to mind — but so far he has composed only two piano concertos. The one under review is a small scale work but a godsend to all those to whom the word melody has not yet become a dirty word. The whole concerto is beautifully compact and Shostakovitch's style in the first movement — cheeky but without vulgarity — is characteristic of him in lighter mood. It is full of vitality, even jubilance. Ogdon's unfailing brilliance receives exemplary support from the Royal Philharmonic under Lawrence Foster.

The romantic slow movement offers many opportunities for wallowing by soloist and orchestra who both firmly reject that temptation — although both are lavish in their controlled use of rubatos. So many bars are reminiscent of Rachmaninov that no prize is likely to be won for spotting them. As sensitively played as it is possible to imagine, it makes a very lovely interlude between the two faster outer movements. All through the concerto Shostakovitch uses the solo instrument pianistically and it can all be summed up as an indubitable compact masterpiece and a most welcome contrast to what so many other contemporary composers nowadays offer as concertos. The scoring ranges all the way from the utmost delicacy to massive climaxes and successfully avoids orchestral cliches. It is full of pastel hues and strong primary colours.

While the Shostakovitch offers instant delight the Ogdon concerto grows on one with repetition. I had the impression that Ogdon is still not quite certain just how he wants to write. Juicy passages are introduced between others full of spiky dissonances, though despite frequent polytonality the concerto remains firmly anchored in tonality. Since it was composed by a superb pianist — as was the Shostakovitch — the writing for the solo instrument is brilliant but never emptily showy. And Ogdon's scoring for large orchestra is always vivid and sure. The brass statements that open and close the first movement have an alien air of rhetoric — just a wee bit slick — but all guaranteed producers of applause where applause is countenanced between movements.

The work's allegiances to Prokofieff are not likely to be missed by any informed musician; not that this matters very much.

It is, after all, Ogdon's first piano concerto and a second should receive a warm welcome. A refreshing point of repose in the elegant slow movement precedes a Finale, a toccata, that rushes along at breathtaking, exhilarating speed with wind in its hair. The playing of both pianist and orchestra is beyond praise.

★ ★ ★

**VERDI — String Quartet in E Minor. WOLF-FERRARI — Serenade. I Solisti Veniti directed by Claudio Scimone. World Record Club Stereo S/5015.**

The sleeve notes by Harry Halbreich (translated by Harvey Blanks) quote a letter of Verdi in which he wrote: "Played by several instruments, this (the quartet) could sound well, for its phrases require a full and round sound, rather than the meagre sound of a single violin . . . it could be necessary to double each instrument and I myself would conduct the orchestra."

Harry Halbreich also quotes another opinion of Verdi "that instrumental music (is) contrary to the genius of the (Italians) and that it (is) best left to the Germans." It would be interesting to learn the personal opinion of the well-informed Mr Blanks on these Verdian statements. He frequently writes authoritatively on music for the World Record Club.

But this is all by way of introducing the fact that Verdi wrote his piece originally for string quartet but later approved the version for string orchestra presented here by a chamber orchestra of 14 players. Verdi is also said to have welcomed the idea of it being played by 80 strings. And as if this weren't enough, an orchestral version received the distinguished sponsorship of the great Toscanini himself. As a rule such purely instrumental pieces when created by composers who devoted almost their entire output to theatre music are early pieces although there are some notable exceptions. One need look no further than Wagner's Siegfried Idyll for an example of the latter. But this quartet of Verdi's was written to fill in time between two postponed productions of Aida and the Manzoni Requiem, a period of full maturity. Although the form might be unfamiliar the material is unmistakably Verdian.

He is lavish in the use of melodies and there is even some drama of truly Verdian urgency. To my ear, although for the most part the work sounds well on a chamber orchestra, there are passages that suffer from translation to that medium. Perhaps not surprisingly the more complex writing is best improved by the use of the extra instruments. There are four movements, of which I found the last two the most interesting. These consist of a prestissimo which might be described as Beethoven with a Neapolitan accent, although the contrasting trio is real Italian hurdy-gurdy music. The Finale, in unusual Scherzo-Fuga form, is a wonderful bit of writing, gay, witty, even frolicsome. It gallops irresistibly towards the finishing post. The first two movements are more or less what one might have expected.

The Wolf-Ferrari Serenade is, unlike the Verdi, an early work. Its composer was only 19 years old but was already displaying evidence of impressive skill and invention. It is for the most part conventional, even in its classico-romantic style. Such pieces used to be known as ear ticklers — that is

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what I think this is and through its shapely length it is never less than pleasing. The sound is excellent, though the playing and perhaps the writing is neater in the Wolf-Ferrari than in the Verdi. The most original movement is the scherzo with its odd tempos and strange air of gentle restlessness. The final, like Verdi's, is in fugal form, most of it taken prestissimo with never a dull bar. A novel disc well worth anyone's consideration.

★ ★ ★

**DUETS FROM THE ROYAL FESTIVAL HALL — Janet Baker (mezzo-soprano) and Dietrich Fischer-Dieskau (baritone) with George Malcolm (organ and harpsichord) and Kenneth Heath (cello) in duets by Francisek Lilius, Heinrich Schutz, Johann Hermann Schein, Henry Lawer, William Lawes, and George Frideric Handel. HMV Stereo ASD2710.**

Of all the months chosen to record a recital live in London's Festival Hall February is probably the most dangerous. For then in addition to the usual hazards of such live enterprises — affected quality of sound, precarious balance, feet shuffling, applause, and other nuisances — February produces the years best crop of respiratory distress in their many audible manifestations.

Yet despite the presence of many of these distracting features this recital is a very worthwhile exercise. Not one of the duets recorded is well known. Indeed you may well never have even heard of some of them. Most were composed between the late 16th and early 17th centuries. Unfortunately I haven't enough space to describe them in detail but all are quite beautifully sung. Texts in English, and when necessary English translations are on the back of this record sleeve.

The moods of the duets vary considerably — sad, noble, comic; even, in one item, "A Dialogue on a Kiss" by Henry Lawes, flippant. Indeed it was in this little piece that these two fine artists reminded me of that late couple Clara Butt and Kennerly Rumford. The English couple were different vocally and personally, of course, and used to make quite a thing of their domestic felicity. I wonder if any of my readers will remember "Madam, will you walk?" which inevitably brought the house down in those simple days long past.

**A review of a World Record Club recording of Donizetti's opera "Roberto Devereux" is unavoidably held over until next month's issue (J.R.).**

**MOZART — Piano Sonata in B Major (K.281). Six Variations in F Major on "Salve tu, Domine" from the opera I Filisofi Imaginarii by Paisiello (K398). Piano Fantasia in D Minor (K397). Piano Sonata in A Minor (K.310). Emil Gilels (piano). Live recording in the Salzburg Mozarteum. DGG 2530 061.**

Although this was also recorded live there are far fewer extraneous audience noises than in the disc referred to above. And happily no applause follows every item. The sound, too, has such commendable clarity that the record might well have been made in a well-equipped studio. Gilels' approach to all the music is a little on the austere side. He certainly makes no attempt to ingratiate himself with his obviously attentive audience. Yet his playing is always faultless and correct, an attitude perhaps best described by the untranslatable French phrase "collet monte" with an acute accent on the last e.

Most of the music sounds as serious as Gilels himself looks in his portrait on the record sleeve. On this disc everything is as reserved as a royal box at the opera. But don't let this put you off. Gilels' pedantic approach may well please you.

★ ★ ★

**THE GOLDEN VOICE OF CONCHITA SUPERVIA. Mezzo-soprano recital of songs by Falla, Granados, Thomas, Bizet and others. World Record Club Retrospect Series 3142. Mono.**

When I first got this record home I hurried to play first the Seven Spanish Popular Songs which I had heard her sing in her own inimitable way in London during the middle 1920s and which she recorded soon afterwards. They were just as spellbinding as I had remembered them during all those years. For in Spanish songs Supervia was indeed inimitable. Her low notes had that edgy, almost masculine quality that I found quite irresistable in her singing of them. I know of no one who has been able to present them quite as excitingly since. The vocal sound is still acceptable though they were recorded back in 1929 and even Frank Mitchell's splendidly played piano accompaniments have worn quite well too. The Granados bracket, Tonadillas, are much prettier, though these, too, she sings in a manner she made quite her own.

Her "Habanera" from Bizet's Carmen, the voice good but the orchestral accompaniment a bit spectral is a marvel of unabashed effrontery; and "Close to the Ramparts of Seville" from the same opera equally wonderful in its luscious coquetry. Also from Carmen is the "Chanson Boheme" which opens the third act, as vital today as it was during her tragically short career, though here, too, the same qualifications must be made about the orchestral sound.

I liked her less in the two meretricious items from Thomas' Mignon. Unaccountably she sings "Knowest Thou the Land" twice, once in French quite well and again in Italian, not so enjoyably, though she changes her style effectively in each. An excerpt from Rossini's La Cenerentola and Musetta's Waltz Song from Puccini's La Boheme are not up to her extraordinary performance of the Spanish music. Her phrasing is sometimes a little ragged and her coloratura, though always wonderfully expressive, not entirely as exact as it might be. But this disc is well worth owning for the Spanish songs alone. I wouldn't part with it for anything. By the way the sleeve notes by her son George betray a lapse of memory on his part. The lady in Ravel's witty L'Heure Espagnole is named Concepcion, not Frasquita as he writes. He must have had one of the Carmen gipsies in mind.

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REVIEWS OF OTHER RECORDINGS

## Devotional Recordings

**THE ORIGINAL SPLENDOUR PRODUCTION. Thurlow Spurr and The Spurrlows. Stereo, Word WST-8535-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)**

The Spurrlows are a capable and very well equipped group which is involved, virtually full time, in touring the USA with Gospel music. The items on this album are taken from a program with which they toured for 9 months, involving 75 cities and 50,000 miles of travelling!

Quieter numbers are intermixed with rock-style Gospel in a performance which is well up to professional standards, particularly on the instrumental side. The titles: This Little Light of Mine — I Believe — He's My Rock — Especially You — He Touched Me — Gonna Come Alive — His Name is Wonderful — I — Precious Lord — Now Walk With God.

While the quieter numbers would have general acceptance, the rock content will appeal more to the youth audience and this is where the album will probably find most of its sales. (W.N.W.)

★ ★ ★

**WALES IN SONG. The Second Festival of One Thousand Welsh Male Voices. Stereo, Columbia SCXO-6440.**

Recorded at the Royal Albert Hall, London, during October 1970, this performance brings together 1000 voices drawn from ten Welsh choirs, each one a fully established choir in its own right. While the program is of varied content, one can safely assume that it will appeal in its entirety to anyone with a prime interest in the devotional tracks.

Conducted by Roy Bohana and with Richard Elfyn Jones at the console of the powerful pipe organ, the massed choirs present: God Save The Queen; Llanfair — Christus, Der Ist Mein Leben; Herzliebster Jesu, Wast Hast Du Verbrochen — Gypsy Chorus ("Il Trovatore") — Speed Your Journey ("Nabucco") — Nile Chorus ("Aida") — Battle Hymn of the Republic — The Bandits' Chorus ("Ernani") — Were You There? — All Through The Night — Y Fedwen Arian — Crimond — The Glory of God — Myfanwy — Cwm Rhondda; Land of My Fathers.

It goes almost without saying that the performance is of a high standard. So also is the recording, though with a few stray surface clicks audible during the hushed passages. Performed before a live audience, each number is greeted with applause punctuated by the occasional whistle. I mention this in case you prefer a dignified silence.

A good recording, though it would not have qualities to set it above quite a few other fine recordings of a similar type. (W.N.W.)

★ ★ ★

**TRY A LITTLE KINDNESS. The Churchmen. Stereo, Word WST-8530-LP. (From Sacred Productions, Aust, 181 Clarence St, Sydney and other capitals.)**

The Churchmen are four young men from Ontario, Canada, who, in 1969, were nominated from a US National Quartet Convention at Memphis, as the group "most likely to succeed". Since then they have continued to minister at Gospel services and conventions, with frequent appearances at Dr Oswald Smith's well known Peoples Church in Toronto. A fifth member of the group is pianist Gary Leno — almost overshadowed in this recording by guitarists and percussion.

The range of material presented here is probably illustrated best by two numbers on side 2 — an up-tempo "Oh Happy Day" a gentle "Somebody Bigger Than You And I" featuring bass soloist Ed Wideman.

Other numbers include: Try A Little Kindness — No Place To Hide — Then Jesus Came (medley) — Turn Around — Why Should I Worry Or Fret? Closer To Thee — That's Enough — The Love Of Jesus.

Good family listening: Something new, something old, etc. (W.N.W.)

★ ★ ★

**HOW GREAT THOU ART. Jim Nabors. Stereo, CBS SBP-234020.**

Jim Nabors has been recording vocal albums for long enough now for one almost to forget the somewhat comic figure of Gomer Pyle that he created for television.

Here the now familiar and powerful voice is once again in evidence, this time in a selection of Gospel songs, recorded against a background of organ, orchestra and chorus. Whether he needs such generous backing or such embellishment of the songs themselves is open to debate. Personally, with a voice of such potential, and with hymns as well known as these, I would have preferred a more straightforward presentation — and without the touches of the "Gomer Pyle" accent.

He sings: How Great Thou Art — Abide With Me — Softly And Tenderly — When The Roll is Called Up Yonder — I Walk With God — My Rosary — Ave Maria — In The Sweet Bye And Bye — Blessed Assurance — God Is Love — God Be With You.

Technically the quality is good but I would prefer to rate the performance as having "average" appeal. If you don't mind generous helpings of arrangement, you'll rate it above average; if you prefer the simpler approach, you'll react the other way. (W.N.W.)

★ ★ ★

**JESUS CHRIST SUPERSTAR. Excerpts. Stereo, DERAM SML-1088.**

Some months ago (July, 1971) I proferred my own evaluation of "Jesus Christ, Superstar" from the devotional viewpoint. Despite its continuing success as a musical, I have had no reason to modify the views then expressed nor, for that matter, has anyone sought to contest them. Its theme may be worthy and it may be good modern theatre but, for most people, it will seem to have little in common with devotion and worship in the accepted sense of the words.

The excerpts in this album have been chosen and the continuity written to emphasise the link between the theme and the Gospel story while the characterisations are neither as extreme nor as protracted as in the original cast production. This might be regarded as a plus.

The tracks: Superstar, Heaven On Their Minds — What's The Buzz, Strange And Mystifying — Everything's Alright — Hosanna — Simon Zealotes, Poor Jerusalem — Pilate's Dream — I Don't Know How To Love Him — Superstar — The Last Supper — Gethsemane — The Crucifixion.

If you like "Superstar" and want a one-album version, you can buy with confidence. The performance is good and the recording likewise. (W.N.W.)

**Reviews in this section are by Neville Williams, Harry Tyrer, Leo Simpson and Gil Wahlquist.**

# *Instrumental, Vocal and Humour . . .*

**RICHARD WAGNER — PRELUDES. Various orchestras and conductors. DGG "Privilege Series", two disc boxed set, stereo 2705 019.**

The ordeal of listening to a Wagner opera, lasting three or four hours, is beyond the endurance of a lot of people. However, the many fine orchestral passages in the operas have always been popular.

The selection in this two disc set includes those which are the most often found in popular selections: Preludes to Acts 1 and 3 from "Lohengrin" — Overture to Tannhauser — Overture to "The Mastersingers" — Prelude to Act 1 and Good Friday Music from "Parsifal" — Prelude and Love Death from "Tristan and Isolde". In addition, there is the purely orchestral piece "Siegfried Idyll". Played by top ranking orchestras under such famous conductors, as Rafael Kubelik, Igor Markevitch, Otto Gerdes and Eugen Jochum, the quality of the performances is all that one could desire. The good quality sound indicates that the tracks are selected from recordings made within the last five years or so. Good value at the DGG "Privilege Series" price of $7.90 for the two discs. (H.A.T.)

★ ★ ★

**BOULEZ CONDUCTS RAVEL. The Cleveland Orchestra and the Cleveland Orchestra Chorus, conducted by Pierre Boulez. CBS stereo SBR 235446.**

The four items presented here are those Ravel works which have become "popular" and therefore have been the most often recorded: Daphnis and Chloe Suite No 2— Pavane for a Dead Princess — Rapsodie Espagnole — Alborado del Gracioso.

I have seen the Daphnis and Chloe music described as "the most ravishingly beautiful score ever to come from the aspiring mind of man". This must surely rank as one of the most ravishingly beautiful performances of it ever recorded. The Cleveland Orchestra had long had my complete admiration, but I have never heard them play better than here. Just ask your dealer to let you hear a few measures of the opening "Break of Day" section, and I am sure you will be convinced.

The "Pavane" is played rather too slowly for my taste, and brings to mind Ravel's comment to a pupil, quoted in the sleeve note: "I have written a Pavane for a dead princess, not a dead Pavane for a princess". However, you may like it this way. It is certainly not lacking in musicianship. Top marks go again to the Rapsodie, which is also beautifully played, but the Alborado, used on side 2 as the filler, again does not entirely appeal to me. The slow middle section has a rather morose quality.

If you want a superb performance of the Daphnis and Chloe suite, this will satisfy the most discriminating listener. You will not be disappointed by the sound quality either. (H.A.T.)

★ ★ ★

**HUNGARIAN RHAPSODIES — Liszt. France Clidat, piano. Decca (EMI) stereo SXLA 7513.**

Four of the Hungarian Rhapsodies are presented here, the ubiquitous No 2, plus Nos 1, 4 and 15 (Rackoczy March). Nos 2 and 15 are those, of course, which have enjoyed the greatest popularity, but the other two are also fine music in the typical highly romantic Lisztian style. And the pianist certainly knows how to make the most of them. Mlle Clidat (one of the few pianists to be awarded the Franz Liszt Prize at the Budapest Festival Competition in post-war days) favours an ultra dramatic approach, emphasising the solemn chords in the slow passages, but playing with plenty of fire and dash in the faster parts — all very appropriate to this music.

The record was awarded the Grande Prix du Disque, reserved for outstanding recorded performance; and it has been very well recorded by Decca engineers. The tone of the piano is a little on the hard side, but this may be due partly to Mlle Clidat's steely fingered playing (H.A.T.)

## *Di Stefano sings Neapolitan songs*

**O SOLE MIO. Guiseppe di Stefano, Tenor. Stereo, Deutsche Grammophon 2-record boxed set. 2705-012.**

Born in Sicily in 1921, Guiseppe di Stefano showed outstanding promise as a singer in his early years but was caught up in the traumas of World War II. However, in 1946, under the guidance of La Scala baritone Luigi Montesanto, he made his first serious stage appearance at Milan in Massenet's "Manon". From that time on he has enjoyed acclaim for many operatic roles in the major theatres of the world.

In this 2-record set he is heard in a different role singing Neapolitan songs, canzonzas and serenatas — might I add with evident pleasure. His voice is powerful, yet true to every note and the same emotion and involvement which one expects in an operatic role shows up here in the full-blooded sentimentality of these Neapolitan songs.

As you might gather, I enjoyed this set, even though I didn't understand a word of the lyrics. Nor would I relish the job of translating or even listing the 23 titles. But they are displayed on the back of the box if you want to take a closer look. A few of the less formidable are: O Sole Mio — O Mese d'e Rose — Vierno — Tutta pe' Mme! — Mamma — Rondine al Nido — Incantessimo — Tristezze.

Recorded with orchestra in Milan and manufactured in Germany by Deutsche Grammophon the recording is right up to standard in the technical sense, with no hint of noise or distortion.

Twenty-three tracks is a liberal helping, particularly for a straight-through sitting but there's not a poor track among them. Thoroughly enjoyable. (W.N.W.)

**THE GREAT HOROWITZ PLAYS CHOPIN. RCA Victrola mono VIC-1605.**

Unfortunately the sleeve note gives no information about the dates when these tracks were recorded, but from the generally poor sound quality I should say they are all remastered from 78rpm discs, some of them very old indeed. Apart from the typical surface noise of the 78rpm disc, there is rumble in some tracks. This is particularly noticeable in the last track, side 2, which has the 12-minute long Andante Spiniato and Grande Polonaise.

Pretty plainly, then, this is not a disc for somebody who must have realistic sound for enjoyment of the music. If you can make the necessary mental adjustment, here is Horowitz, presumably in his prime, in a program of popular Chopin, comprising: Ballade in G minor — Waltz in C sharp minor — Impromptu in A flat — Nocturne in E flat — Study in C sharp minor — Scherzo in B minor — Mazurka in C sharp minor, Op 50, No 3 — Andante Spiniato and Grande Polonaise. Horowitz's interpretations have tended to be overshadowed by his brilliant technique, and he displays little more than this in some of the shorter pieces presented here. However, there is no trace of the "soul-less virtuosity" of which he is often accused in the Ballade, and one can only marvel at his dexterity in the Study and the Scherzo. As a souvenir of a great artist, this disc is worth having at the low Victrola price, despite its deficiencies (H.A.T.).

★ ★ ★

**THE WORLD OF GYPSY ROMANCE. Laszlo Tabor and his orchestra, with Jack Laroque, solo violin. Decca Stereo SPA 117.**

This is a mixture of traditional and light classical music, mostly Hungarian and Russian. As such it is not strictly speaking true gypsy music, but it has long been the custom to relate this type of music to gypsies, however wrongly. As sheer musical entertainment, it is enjoyable enough. The playing of the orchestra is of a high standard, and the tunes are all very familiar, although some of them more so under their original titles than those given here. For example the opening and closing items in the program are called Gypsy Dances, but they will be recognised as Brahms's 5th and 6th Hungarian Dances respectively; a track titled "Gypsy Air" is actually Dvorak's "Songs My Mother Taught Me" . . . and so on. The remaining tracks are: Gypsy Tears — Two Guitars — Czardas (Monte) — Bohemian Dance — Dark Eyes — Play Gypsy, Dance Gypsy — Romany Violin.

Every one of these pieces has a fine melody, which is highlighted by the excellent violin solos of Jack Laroque, playing a fiddle of beautiful warm tone. The sound and stereo spread are fine — particularly for a budget price disc. (H.A.T.)

★ ★ ★

**IAIN KERR'S FOUR KEYBOARDS. CBS stereo SBP 234028.**

Iain Kerr is the piano-playing half of the Goldberg and Solomon comedy team, which recently toured Australia. Apparently he is a classically trained pianist, and here he plays a selection of popular classics arranged for keyboard instruments, with rhythm section. By overdubbing, he plays the parts of all four instruments, but un-

fortunately the sleeve note leaves one to guess what the instruments are. Apparently they are all electronic instruments, one having the typical Hammond organ sound, another appears to be a different brand of organ, one could be an electronic spinet or something similar, and the fourth is anybody's guess.

It all goes together quite nicely, and apart from a slight slip here and there, Iain Kerr copes with the difficulties of integrating the four parts well enough. He introduces a certain amount of swing into the performance, which most other performances of this type do not do nowadays. I suggest trying to hear a track of two before making your decision.

Here are the titles: Theme from second movement of Symphony No 5 (Tchaikovsky) — Humoreske (Dvorak) — Waltz from "Serenade for Strings" (Tchaikovsky)—To the Spring (Grieg) — Theme from Study No 3 "Tristesse" (Chopin) — Jesu Joy of Man's Desiring (Bach) — Theme from Nocturne No 3 (Chopin) — Adagio from "Moonlight" Sonata (Beethoven) — Hedge Rose (Schubert) — Theme from Piano Concerto (Grieg) — Sleepers Awake (Bach) — Theme from Pathetique Sonata (Beethoven. Sound quality — satisfactory. Stereo spread — good. (H.A.T.)

★ ★ ★

**THE THIRD MAN. Anton Karas and the Two Rudis. Fontana Special (Phonogram Recordings Pty Ltd) stereo 860 000 WPY.**

Although it is now some 15 years since the "zither man" Anton Karas burst upon the entertainment scene with his music for the film "The Third Man", his music still commands a sizable audience. Only recently we had one reissue, which appeared to be tracks from about the same time as the film. This disc under review is obviously from a later period, perhaps about five years ago. The sound quality is too good for it to be older.

Here, Karas is joined by the "Two Rudis", playing accordion and bass, and between them they play just the kind of program one would expect — the "Third Man" music, plus a collection of those cosy German titles with which the folk song literature of the region abounds. All very pleasant for background material, but not particularly suitable for solid listening. The recording has a very bright quality, which tends to emphasise the peculiar jangly quality of the zither, but I hesitate to say this is a recording fault. If you like the zither, this disc is good value at its budget price. (H.A.T.)

★ ★ ★

**GOLDEN EASY LISTENING. Royal Grand Orchestra. Columbia Stereo SOEX-9758.**

Outstanding sound quality is the feature of the "Golden" series of albums from the Royal Grand Orchestra recorded in the Tokyo studios of Toshiba Musical Industries. It must be admitted, though, that tape hiss is evident on some tracks. The musical arrangements and playing style are reminiscent of the Franck Pourcel orchestra and as such it is ideally suited for dining or dancing.

There are 12 tracks: Do You Know the Way to San Jose — Sealed With a Kiss — Raindrops Keep Falling on My Head — La

Reine de Saba — Love Is Blue — Manchester et Liverpool — Maltese Melody — I'll Never Fall In Love Again — California Dreaming —This Guy's in Love With You — By The Time I Get To Phoenix — Bridge Over Troubled Water. (L.D.S.)

★ ★ ★

**PAIS TROPICAL. Sergio Mendes and Brasil '77. A&M Records stereo SAML-934310.**

This is the first disc from the new Brasil '77 troupe of Sergio Mendes. Gone is the strong "bossa nova" rhythm and in its place is a more intricate latin / Spanish sound. Some will not like the change but the new group certainly has a great deal of musicianship and potential to develop. We suggest you listen before you buy.

One point that has certainly improved is the sound quality which is now very good. Nine tracks are featured to give a total playing time of 34 minutes. Tracks presented are: Pais Tropical — So Many People — Morro Velmo — Zanzibar — Tonga — Gone Forever — Asa Branca — I Know You — After Midnight. (L.D.S.).

★ ★ ★

**EQUINOX. Sergio Mendes & Brasil 77. Mayfair (A&M Records) stereo SMF66-9921.**

While this record purports to be the new Brasil 77 group it is actually a collection of tracks previously put down by the Brasil 66 troupe. This is no reason for the Sergio Mendes fan to veer off, however. The quality of this economy label seems better than previous releases on the full-priced A&M albums. If you do not have these tracks in your present Sergio Mendes collection, then this disc should not be missed.

The titles are: Constant Rain — Cinnamon and Clove — Watch What Happens — For Me — Bim-bom — Night and Day — Triste — Gente — Wave — So Danco Samba. (L.D.S.)

★ ★ ★

**MAMY BLUE. Raymond LeFevre and his orchestra. Calendar stereo SR66-9944.**

"Mamy Blue" is probably one of Raymond LeFevre's most successful albums to date. It has already become popular on the easy listening programs of Sydney's radio stations. To my mind though, it is a mixed bag. While "Mamy Blue" and some of the other tracks have undoubtedly good arrangements, other tracks are less interesting. At Calendar's low price, though, it is still good buying.

Sound quality varies from fair to good and "inner groove" distortion is noticeable. The stereo spread is normal. There are 11 tracks beside the title track: The Fool — Mourir D'aimer — Allegro Du Grand Siecle — Le Jour Se Leve — Pour Un Flirt — Le Casse — Here's To You — Adagio De La Sonate — Au Clair De Lune — Adagio Du Concerto — En Dom De Marcello — We Shall Dance — Jo. (L.D.S.)

★ ★ ★

**LAWRENCE WELK Plays Jerome Kern and other great composers. Stereo, Interfusion (Festival) SITFL-934330.**

Coming from the mellifluent baton of Lawrence Welk, there would be something utterly unexpected and "wrong" about this album if it were anything but tuneful and very easy on the ear. Nor should one forget the influence of Jerome Kern and his peers.

The aging but enduring show favourites include: Smoke Gets in Your Eyes — As Long as He Needs Me — My Romance — Long Ago and Far Away — All The Things You Are — Orchids in the Moonlight — The Song is You — Lovely To Look At — A Fine Romance — Make Believe.

The big band sound is well balanced and cleanly recorded and, if you like the numbers, you'll like Lawrence Welk's account of them. (W.N.W.)

★ ★ ★

**DOWN MEMORY LANE. Various artists. Stereo HMV Series 275, SOELP—9854.**

Coincidentally, a few days before this record came to hand, a friend had been expressing his regret that so few albums were available with a program of varied artists. Well, this one should be just the thing for people with similar ideas — provided that the idea also appeals of a long stroll down Memory Lane. Try these for size:

When You're Smiling, Red Roses for a Blue Lady (Des O'Connor) — A Nightingale Sang, Cruising Down the River, Anniversary Waltz (Vera Lynn) — Mighty Like A Rose, Danny Boy (John Boulter) — Moonlight and Roses, Roses of Picardy, Love Letters in the Sand (Vince Hill) — Indian Summer, Smoke Gets in Your Eyes

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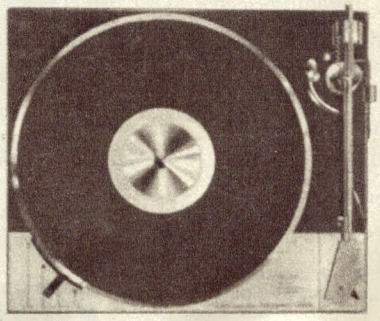

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## Philips "Youth Series"

A new series of records from the Philips catalogue, released here by Phonogram Recordings Pty Ltd, have been designed to appeal particularly to the younger record buyer with an awakening interest in classical music. The contents are single movements of longer works, or complete shorter works. High quality packaging, featuring eye-catching artwork and folding sleeves, should attract maximum attention on dealers' shelves. The following three discs were included in the first release of six titles.

**BAROQUE AROUND THE CLOCK. Stereo 6585 004.** Music from the baroque period, naturally, beautifully played by leading exponents of this kind of music, including I Musici, The English Chamber Orchestra (conductor Raymond Leppard), and the German Bachsoloists. The eight items here are: Oboe Concerto by Albinoni, Allegro e non presto (Heinz Holliger, oboe) — Storm at Sea, by Vivaldi, Allegro-Presto — Movements from Suite No. 2, by Bach — Largo e Allegretto, by Marcello (Maurice Andre, trumpet; Laurence Boulay, harpsichord) — Spring, from "The Four Seasons", by Vivaldi — Introduttione Teatrale No. 5, by Locatelli — Rondeau from Oboe Concerto in F, by J. C. Bach (Heinz Holliger, oboe) — Sinfonia from Cantata 169, by Bach.

★ ★ ★

**TWO OF A KIND. Stereo 6585008.** All the pieces in this selection use two instruments of the same kind in lead parts, hence the disc title. The tracks include movements from concertos for two harpsichords, two trumpets, two oboes, two pianos and two mandolins. The last piece, Schubert's "Marche caracteristique", is for piano duet. Again, only top ranking performers are featured, and it would be a very critical listener who could fault the performances. The baroque composers are strongly represented, taking up most of side one, (Bach, Vivaldi, Albinoni). The Spanish composer Soler is represented by an interesting Andantino from his Concerto for two harpsichords, and Mozart by the rondo movement from Concerto for two pianos in E flat, K.365. Other items are by Purcell and somebody new to me, Vejvanowsky. This 17th century composer is represented by "Intrada" for two trumpets, a pleasing piece in the baroque style.

★ ★ ★

**ARMISTICE DAY. Stereo 6585 006.** I suppose the producer of this one has tried to create a kind of war and peace atmosphere. It is an odd mixture, slanted towards contemporary composers, who apparently are exercising a considerable appeal for younger folk today. The disc begins and ends with an excerpt from Shostakovitch's Symphony No 12, "The Year 1971", and has a short passage from the same composer's Symphony No. 5. Three items by Penderecki are "To the Victims of Hiroshima", "Dies Irae: Et Vidi Bestiam", and excerpt from "Polymorphia". For more traditional tastes, there are a march by Lully; Trumpet Tune and March of the Duke of Ormond, by Croft; and the Andante from Brahm's Symphony No. 3. The orchestras performing are not listed. This is one you should hear for yourself before coming to a decision.

Released at the same time, but not received for review, are the following titles:
REPERCUSSION. Stereo 6585 005. This has works for percussion instruments, apparently by contemporary composers (Kabelac, Silvestrov, Salzedo).
AMERICANA. Stereo 6526 017. This has three contemporary works: Ionisation by E. Varese — Tambuco, and Toccata, by C. Chavez— First Construction (in metal), by J. Cage.

The technical quality of the discs actually received was of a high standard throughout. (H.A.T.)

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(Gracie Fields) — Galway Bay, I'll Take You Home Again, Kathleen (Brendan O'Dowda) — Lambeth Walk (Norman Wisdom) — Roamin' in the Gloamin' Medley (Andy Stewart).

Though I imagine that the recordings must have been assembled from a variety of tapes, there's no need to worry about uneven sound quality. It's excellent throughout. Good value if the contents appeal. (W.N.W.)

★ ★ ★

**A PLACE IN MY HEART. Nana Mouskouri. Fontana stereo 6312 022.**

Many readers will be familiar with Nana Mouskouri and her style of singing from her appearances on ABC television. For those not familiar, Nana is a folk singer whose style can best be described as "chaste" i.e. as one would imagine the singing of a novice in a convent. Nowhere is this more apparent than in her presentation of "Love Story" which is absolutely devoid of any emotion or desire. As such, her singing style will appeal to many but for me it is too bland.

In other respects, the recording is of high standard. Stereo spread is normal and surface noise on my sample pressing was negligible. The tracks are as follows: Outward Bound — Put Your Hand In The Hand — Deep and Silent Sea — Sons Of — We Don't Know Where We're Goin' — Long Days Dying — A Place in My Heart — Attic Toys — Nickel Song — Plaisir D'Amour — Chimbalom — Love Story. (L.D.S.)

★ ★ ★

**SAY YOU LOVE ME. Lucille Starr, with orchestra. Mayfair (Festival) stereo SM-F66-9937.**

What a pity that Lucille Starr does not make more records! That such talent is not used more by the recording industry is a crying shame. I believe she is among the best country and western singers in the field today, yet she has had only one disc released here in five years of more. This present one is a reissue of that disc, first issued about three years ago, and now available on the low price Mayfair label. Miss Starr's singing is in a class by itself in the C & W sphere. She sounds like Patsy Cline, Vikki Carr and Shirley Bassey rolled into one, her phrasing is superb and her diction a delight. And what is more, she

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EA-STT-272

## Leontyne Price as Verdi Heroines

**VERDI HEROINES. Leontyne Price, soprano, with various artists and orchestras. RCA Red Seal stereo VCS-7063. (Two record set.)**

In line with the current trend of assembling tracks in double album sets to sell at a special price, RCA have given us here a selection from recordings made by American negress Leontyne Price, who has won almost universal praise for her performances in Verdi operas. Her rich, full voice, with its carefully controlled vibrato, is already known to record buyers with a liking for Verdi operas, as Miss Price has made numerous recordings in these roles. The selections here are from full opera recordings in the RCA catalogue, and presumably the major appeal will be to those with an awakening interest in this sphere of music, rather than to the experienced listener and record buyer.

Miss Price is featured in eight roles and 15 arias or scenes: As Aida, singing Ritorna Vincitor! — O Patria Mia; as Lady Macbeth in the Sleepwalking Scene; as Violetta in "La Traviata" singing Tenesta la Promessa — Addio del Passato; as Elvira in "Ernani" singing Surta e la Notte — Ernani, Involami; as Desdemona in "Othello" singing Era Piu Calmo — Willow Song — Ave Maria; As Amelia in "Un Ballo in Marschera" singing Ecco l'Orrido Campo — Ma Dall'arido Stelo Divulsa — Morro, ma Prima in Grazia; as Leonora in "Il Trovatore", singing Che piu t'Arresti — Tacea la Notte Placida — D'Amor sull'ali Rosee; as Leonora in "La Forza del Destino", singing Me Pellegrina ed Orfana — Son Giunta! — Madre, Pietosa Vergine — Il Santo Nome di Dio — La Vergine degli Angeli — Pace, Pace, mio Dio.

Singing, orchestral support and recording quality are all of a high standard, and as an introduction to Verdi operas, this can be recommended. (H.A.T.)

communicates. If you have not previously heard Lucille Starr, and you doubt whether any singer can be as good as I claim, I suggest you go and have a listen at your dealer.

The 11 tracks in this recording include: Gone — I Don't Mind — So Many Others — Send Me No Roses — Adios Aloha — My Happiness. The recording, from the A&M Studios, is fine, but the cover artwork is a disgrace. (H.A.T.)

★ ★ ★

**HITS A LA HAMMOND. Pete Colley. Stereo, Karussell 2495-001.**

This album relies on the now time-honoured formula of a Hammond organ plus percussion. But whereas the early exponents of the formula relied on the smooth sound of the early Hammonds, Pete Colley has access nowadays to a greater range of sound colour and percussive effects. And, of course, the Jerome Kern kind of material has given place to more recent titles:

Lily the Pink — Boom Bang A Bang — Winchester Cathedral — Casatschok — Rain And Tears — Hey Jude — Hello Dolly — Goodbye — Delilah — Michelle — Georgy Girl — Arriverderci Hans.

Well played, pleasant cabaret style sound for those who are partial to the electronic organ. (W.N.W.)

★ ★ ★

**GREATEST HITS. Booker T. & the M.G.'s. Stax stereo 2325 018.**

**SOUL LIMBO. Booker T. & the M.G.'s. Stax stereo 2325 001.**

In this reviewer's opinion, Booker T. and the M.G.'s are one of the best popular instrumental groups in the world today, although, as may be evidenced by these two discs, they could use more of their own original material. The over-riding characteristic of their music is a driving rhythm that seems as powerful as a steam locomotive. It really gets the swingers going at a party.

We are reviewing these two records together as five tracks are common to both. This seems a little unusual as they have been released simultaneously in Australia and as a consequence fans of Booker T. are likely to buy one rather than both discs.

The recording quality and stereo spread on both discs was good but tape hiss was noticable on some tracks. The five tracks common to both discs are: Soul Limbo — Hang 'Em High — Over Easy — Eleanor Rigby — Heads or Tails.

The "Greatest Hits" album has six more tracks: Time is Tight — Mrs Robinson — Something — Johnny, I Love You — Meditation — Hip Hug-her.

The "Soul Limbo" album also has another six tracks: Be Young, Be Foolish, Be Happy — Lala Means I Love You — Willow Weep For Me — Since You've Been Gone — Born Under a Bad Sign — Foxy Lady. "Greatest Hits" is probably the better album. (L.D.S.)

★ ★ ★

**MY HEART HAS A MIND OF ITS OWN. Connie Smith. RCA Camden stereo CAS-2495.**

Every now and again one comes across a record where the sleeve notes seem to be in complete agreement with your own opinions. I suppose then you can be classed as a fan of the particular artist. Connie Smith certainly must be classed as one of the best C&W artists alive today. She has a powerful, resonant voice charged with emotion and her professional style of singing is in complete contrast to the rank amateurism which seems to plague so many C&W singers. Against this, her voice seems just a little too nasal and needs toning down.

Sound quality on the sample pressing was good and stereo spread of the instrumental accompaniment was wide. The album has 10 tracks: My Heart Has a Mind of Its Own — I Don't Know Why I Keep Loving You — Ain't Had No Lovin' — The Hurtin's All Over — Two Empty Arms — I Don't Love You Anymore — It's Not The End Of Everything — I'll Be There — That's What It's Like To Be Lonesome — The Other Side Of You. (L.D.S.)

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**MR. ATKINS — GUITAR PICKER. Chet Atkins, guitar, with orchestra. RCA Camden stereo OCS-2464.**

It is arguable that Chet Atkins is the world's leading guitar player in the popular / country and western field. The effortless manner in which he can handle tricky numbers such as "Kicky" on this disc is an object lesson in musicianship. Unfortunately, whoever selected the tracks for this re-issue from previous recordings picked them mainly of the same type, so that the versatility Chet so often displays is not in evidence here. Nevertheless, what is offered is a sparkling display of guitar technique. Other tracks are: You're Just in Love — Early Times — Walk, Don't Run — El Cumbanhero — Anna — Love Letters — Yankee Doodle Dixie — Shadow Waltz — Satan's Doll. Ten tracks in all, with the typical Camden playing time of around 12 minutes a side. The sound quality is clean, and stereo spread normal. (H.A.T.)

★ ★ ★

**UNDER THE BRIDGES OF PARIS. The Magic Accordions of Adriano. Columbia (EMI) stereo SOEX 9693.**

It is not difficult to deduce from the information above that this is a selection of French tunes featured in accordion arrangements. Despite the plurality implied in the credits, there appears to be only one accordion in most tracks, and this is backed by a small orchestra. It is pleasing enough, but not up to the standard of the best continental accordion players. The playing is a little too measured, lacking the carefree, floating air of the French musette style. If you have a liking for accordion music, and the titles appeal, I suggest you try to hear a few tracks before buying.

Under the Bridges of Paris — Petite Fleur — The Wee Boy of Brussels — Padam, Padam — Tour Eiffel — The Song from Moulin Rouge — Milord — Irma la Douce — Autumn Leaves — Bossa Notre — Live for Life — Soul Coaxing — Why Do You Pass Me By — That's Paris. The technical quality is entirely satisfactory. (H.A.T.)

★ ★ ★

**MEXICAN FIESTA. Pepe Jaramillo with his Latin American rhythm. Parlophone stereo SPMEO-9687.**

Some years ago I used to listen with enjoyment to a friend's copy of this record but regretted not being able to obtain it. Now it has been re-issued at an economy price which makes it a bonanza for Latin-American music fans. Pepe Jaramillo is well known in America, Britain and of course, his native Mexico. He has also been featured on ABC-TV. He plays piano in a very professional style and is backed by a very able rhythm group which, although it is strict tempo, never sounds stilted.

It is just right for dancing and the dance appropriate to each tune is marked on the sleeve. Although recorded about ten years ago, the sound quality is good but has just a trace of tape hiss. Stereo spread is very wide and even.

The titles listed are: Green Eyes — Cachito — The Breeze And I — Amor — Siboney — Sway — South Of The Border — El Choclo — Stairway To The Sea — Torero — To Be or Not to Be — Capullito de Aleli — Man Who Plays The Mandolin. (L.D.S.)

**THE DIONNE WARWICK STORY — IN CONCERT THROUGH THE YEARS. Scepter (Festival) stereo SJL-181 / 2.**

The even quality of Dionne Warwick's performances throughout the lengthy program presented here is a tribute to her qualities as an entertainer. She maintains a sparkling good humour everywhere, carrying her audiences along with her, and obviously enjoying every moment of it. I imagine that all these tracks were recorded during a single tour some years ago, or at least during tours made over a short period. Every one of the numerous tracks has applause and other audience noises, but this is not particularly obtrusive, and it does heighten the sense of occasion.

There are 44 titles listed in the credits, and even allowing for the fact that some of these are touched on only briefly in the medleys, there is still a very generous measure. In all, playing time is around 1½ hours — which is good value for a mere $7.95. The titles include such Warwick standards as Alfie — I'll Never Fall in Love Again — What the World Needs Now — Promises, Promises — Thank Heaven for Little Girls — Valley of the Dolls, and so on — too many to list in full. The recording is of reasonable quality for live performances, but appears to be mainly in mono, with added stereo audience noises to give atmosphere. (H.A.T.)

★ ★ ★

**CANTA, CANTA. Maria Ostiz, soprano, with chorus and orchestra. Hispavox (Festival) stereo SHVL-934392.**

Many people who have heard Spanish soprano Maria Ostiz singing "Song of the Nightingale" on the radio, and have tried in vain to obtain the recording containing this track, will be delighted to know that Festival have issued it here. Recorded in Spain by the Hispavox company, this disc contains a selection of mainly Spanish ballads and traditional songs.

Maria has a bell-like soprano which is absolutely true to pitch, and this is demonstrated particularly well in the "Nightingale" number, where a semi-coloratura passage calls for a voice able to climb high up the scale and a sure technique. This is undoubtedly the best track, but all the other numbers are pleasing, each with its own special appeal. Eight of the ten tracks have Spanish titles, the remaining two having what I take to be Greek names. Here are the names of the Spanish songs, with my translations, which may be of assistance:

Naverina do Mar (Little Boat of the Sea) — Mil Rosas (A Thousand Roses) — Pequeno Vals (Little Waltz) — Cancion del Ruisenor (Song of the Nightingale) — Canta, Canta (Sing, Sing) — Piedras Rojas (Red Rocks) — Nana a una Madre Frustrada (Lullaby for a Frustrated Mother) — Los Sanfermines "Uno de Enero" (The Bands of New Year's Day): I am sorry I cannot translate the titles of the two tracks "Maite" and "Aurtxoa Seaskan", which I take to be Greek.

The choral and orchestral backing is tasteful and complements the soloist without being too intrusive. Harpsichord and guitar are prominent in some of the arrangements, expertly played. The sound quality is good, if unexceptional, and the stereo spread is normal. (H.A.T.)

# PRODUCT REVIEWS AND RELEASES

## Garrard Zero 100 Automatic Player

After much fanfare overseas, the Garrard Zero 100 has finally been released in Australia. It is an automatic turntable with an articulated tone arm designed to provide "zero" tracking error over the whole of the record surface. It was submitted for review by Audioson International Pty Ltd.

Apart from the arm, the construction of the Zero 100 follows common practice. It uses a pressed steel baseplate finished in white enamel. The platter is an 11½in diameter aluminium diecasting which is riveted to a steel pressing of 10¼in diameter driven by the idler wheel. The motor drives the idler via the usual stepped pulley which is also slightly tapered to give a range of speed adjustment. Operating speeds are 33 and 45 rpm.

The motor is Garrard Synchrolab unit which is of the "hysteresis-synchronous" type — i.e., it operates as an induction motor when starting and as a synchronous type when up to speed. It emits very little vibration and is well shielded against hum radiation. Starting torque is high and the platter attains operating speed in less than half a revolution.

A feature not often seen on today's turntables is the neon-lit stroboscope. A card carrying the strobe markings is glued to the underside of the turntable platter, lit by a neon lamp and is viewed with the aid of a mirror through a window in the base-plate. This enables speed to be set very accurately, with the aid of the fine speed control, when the record is playing.

Two record spindles are supplied with the Zero 100. A short spindle clips into the platter centre and rotates with it for single record playing. For automatic multiplay operation, there is a conventional long spindle which can accommodate up to six records.

There are two methods in general use to support records on an autochange spindle. One is the "umbrella rib" type seen on German changers and the other is the record stabiliser arm seen on BSR changers. The Garrard Zero 100 uses a third method — the support platform, positioned near the counterweight. This has the advantage that the records are supported in two places instead of one.

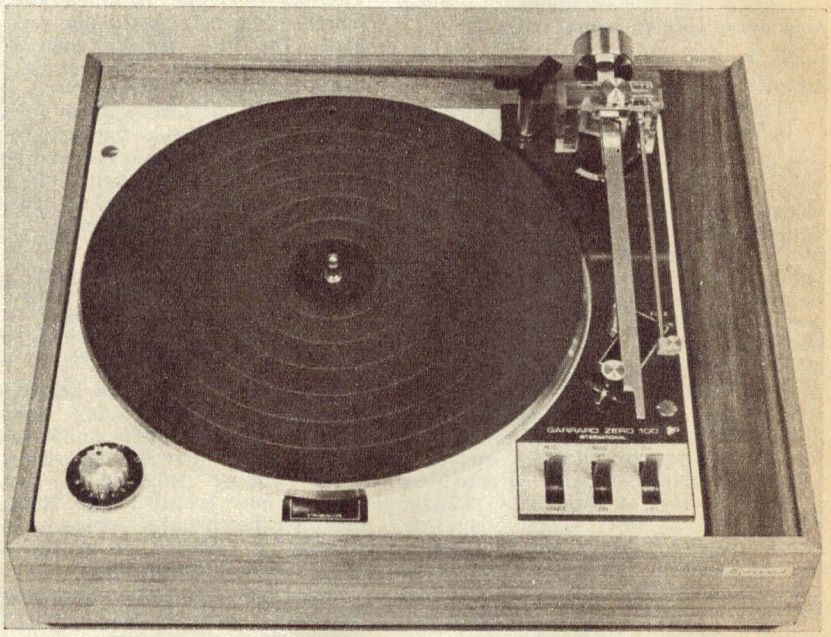
As with most other record changers available today, the Garrard Zero 100 is not equipped to handle a mixture of different record sizes — all records on the stack must be the same diameter. The arm set-down position is guided by the speed / change cum record diameter selector and the user must be careful not to set the changer in operation without a record on the platter.

Three lever switches control operation of the player. From the left, the first lever controls the auto stop / start operation for single-play or multiplay and acts to reject a record during multiplay. The centre lever stops or starts the turntable for manual operation. The arm automatically lifts off the record and returns to the rest regardless of the mode of operation used. The idler wheel is automatically disengaged at the end of play to prevent the formation of flat spots.

The remaining lever is the hydraulically damped cueing facility. On our sample, the lowering action was gentle over most of its travel but seeming to "let go" at the last moment. This may be quite deliberate to cope better with slightly warped records.

Major feature of the Zero 100 is the tonearm, which is designed to virtually eliminate lateral tracking error — an acknowledged source of predominantly second-harmonic distortion. It employs a pivoted headshell and a supplementary guide rod to maintain an exact tangential relationship between the headshell and the record grooves. The arrangement is similar in principle to the articulated windscreen wiper used on some late model cars.

The idea of articulation is not new — articulated arms to minimise tracking error have been commercially produced from time to time but they have been hampered by high bearing friction and the possibility of undesirable resonance modes. After all, the articulated design uses four bearings instead of one lateral pivot in conventional arms. Garrard have certainly tackled the problem very well. However, it is reasonable to assume that, in the overall view, they will have inherited some penalty in lateral drag when compared with other premium quality players using rigid arms and one bearing only.




Initial balance in the vertical plane is accomplished by a large counterweight which is somewhat "fiddly" to adjust because of its extremely resilient "decoupled" suspension. Initial balance having been set, tracking weight is adjusted by a sliding weight on the underside of the arm. Tracking weight calibrations are from 0 to 3 grams.

A clever method is used to apply anti-skating compensation to the arm. There are two opposed ring magnets, one on the arm pivot, the other on the perspex bridge over the arm pivot. A magnetic shield slides between the two magnets to adjust the force. This method is surely ideal as it does not add friction or "stiction" to the system.

In use, the Zero 100 functions reliably and quietly. Speed accuracy, wow and flutter are all quite acceptable. We measured rumble at —34dB with respect to 5 cm / sec. This is the kind of figure one expects from idler driven turntables as a class, being somewhat short of the standards achievable by belt-driven units. This is another way of saying the rumble may be evident if you have loudspeakers with an extended bass response.

The main control levers are very light to the touch but the speed change knob was rather stiff to operate.

The multiplay facility is not as gentle with records as we would like but probably most potential buyers would not use it often. Most enthusiasts playing the records they care about would normally revert to autoplay, leaving the changer facility for "mood music" discs.

In short, the Zero 100 is really a player with two distinct roles. It can take a stack of records and play them automatically with better than average characteristics. Alternatively, with a change of the spindle, it can be used as a quality automatic player.

There is one problem with the multiplay facility which is probably not unique to the Garrard Zero 100 — that of difficulty in handling the new "ultrathin" LP's made by RCA and other record manufacturers.

Being so thin, these records tend to droop when they are stacked on the autochange spindle. Consequently, the arm tends to foul the bottom record on the suspended stack when it is going through the change cycle, producing a marked disc. As pointed out above, problems with these records are not unique to the Zero 100, or even to automatic changers.

On our sample, the headshell was not quite parallel with the record surface, when looking at the "end view". This meant that we had to pack up one side of the cartridge to obtain proper orientation. This may have been an assembly fault in our sample only, but there was no adjustment to correct the condition.

We found the tone arm tracks and trips the changer mechanism reliably at tracking weights down to 1 gram, but to be on the safe side, 1½ grams would appear to be a practical tracking weight. The anti-skating force seemed to be rather too high even at minimum setting and this could have prejudiced the tracking performance.

Viewing the output of a cartridge with the aid of an oscilloscope, the zero tracking error arm does indeed appear to clean up the waveform noticeably. But we could detect no audible difference when comparing the same cartridge in a conventional arm. This is to be expected since second harmonic distortion is generally not unpleasant and the distortion produced by the cartridge due to other factors is relatively large.

As a basis for judging the Garrard Zero 100, it must be considered as a well-made automatic turntable with an unusual arm. Whether or not the complicated arm is worth the extra expense is perhaps a moot point — the arm will have to prove itself on the open market in comparison with those of more conventional design.

Recommended retail price is $268.00, including sales tax, and the unit is available from outlets throughout Australia. The Garrard Zero 100 is distributed in all states of Australia except NSW, by Audioson International Pty Ltd, who submitted the unit for review. Their address is 64 Winbourne Road, Brookvale, NSW 2100. NSW distributors are British Merchandising Pty Ltd, 49-51 York Street, Sydney, 2000. (L.D.S.)

# Onkyo 725 Stereo Amplifier

New to Australia, the Onkyo model 725 is a medium powered stereo amplifier with a wide range of operating facilities. Our sample was submitted for review by Miranda Stereo and Hifi Centre.

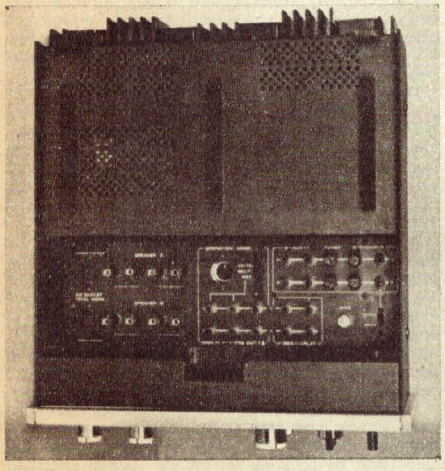
Onkyo is a new name to the Australian high fidelity market and lest readers throw their hands up in disgust at hearing yet another Japanese brand name, let us state that it appears to be a better product than many other more well-established brands.

For a medium powered amplifier, the Onkyo 725 is relatively compact. Dimensions are $12\frac{1}{4}$(w) x $5\frac{1}{4}$(h) x 14(d) inches, including knobs and heatsinks. Net weight is $17\frac{1}{2}$ lb. It may be used free-standing or mounted in a cabinet, provided ventilation is adequate.

An extruded aluminium control panel accommodates quite a profusion of knobs and switches: Six knobs, seven lever switches and one push-button. Two dual potentiometers perform the functions of volume and balance controls, while rotary switches are used for bass, treble, selector and mode controls.

Input selection is provided by a combination of two switches; a 4-position rotary switch and a 2-position lever switch. This seems a little unnecessary as the same function could be performed by a 5-position rotary switch. Mode selection is performed by a 5-position rotary switch and the lever switch for Tape Monitor complete the input selection facilities. The five remaining lever switches provide a choice of two loudspeaker systems, low and high filters, loudness and muting (-20dB). A push-button is used for the power switch — it also mutes the amplifier at switch-on and switch-off to avoid clicks and thumps from the loudspeakers. A headphone socket is provided for low impedance phones.

The rear panel of the amplifier is almost completely occupied by the fluted-fin heatsinks for the output transistors. The output transistor cases are covered by steel brackets to avoid contact with the user's fingers or clumsily wielded screw-drivers.



*Terminal panel on the Onkyo model 725.*

The unique feature of the amplifier is the recessed panel underneath the perspex window in the top cover. This accommodates all the input and output connections, so that probing around the rear of the chassis is eliminated. Ten pairs of phono sockets are provided for the following: 2 magnetic phono inputs and 3 high-level (100mV / 100K) inputs; tape inputs and outputs, amplifier input and 2 preamplifier outputs. Two 2-pin mains outlets are provided, one switched and the other unswitched. Four pairs of terminals are provided for connection of the loudspeakers. These terminals will accept bared wires, banana plugs or spade lugs.

Removing the top portion of the chassis reveals a neat but tightly occupied interior. The power transformer is a C-core type which cuts down weight and improves efficiency.

Since we did not have access to a circuit diagram at the time of writing we cannot make detailed comments on the circuit. The power amplifiers use balanced positive and negative supply lines so that output coupling capacitors are eliminated. The output transistor configuration is quasi-complementary and output transistor and loudspeaker protection is provided, at least in part, by fuses.


The tone controls are of the negative feedback type with the switches being used to modify the turnover frequencies. This confers an advantage over the usual NF type tone control using potentiometers — these are "variable slope" controls which tend to concentrate their audible effect at the extremes of potentiometer travel. As such, the switches are very effective and do not cause clicks to be emitted from the loudspeakers. Bass and treble boost and cut are applied in 2dB steps at 10KHz and 100Hz.

In operation, we found the amplifier to be very quiet. In fact, as the figures show, it is one of the quietest amplifiers we have ever tested, both in terms of signal-to-noise ratio which is a relative test or residual noise which is absolute. At no time does it emit clicks or thumps when operating controls and we had no problems with RF breakthrough, regardless of the input in use.

On test, the amplifier performed very well and conformed closely with its comprehensive specifications. Continuous power per channel into 16 ohm loads was 19 watts with one channel driven or 16 watts with both driven. In both cases, the harmonic distortion was less than the rated figure of 0.1%. Continuous power into 8 ohm loads was 28 watts with one channel driven and 24 watts with both driven, for a harmonic distortion level of 0.15%. Into 4 ohm loads, continuous power was 30 watts with one channel driven and 25 watts with both driven, for harmonic distortion of 0.2%. All figures refer to 1KHz.

At lower power levels, harmonic distortion was reduced to well below 0.1%, at which point our distortion figures become inaccurate due to residual distortion in the test equipment.

Frequency response at a power level of 1 watt into 8 ohms was +1dB from 15Hz to 50KHz. Tone control figures confirmed the spec at +10dB at 100Hz and 10KHz. The high and low filters are not sharp enough,

**(Continued on page 103)**

## *Sharp Compet 363P Electronic Calculator*

With the advent of large-scale integration techniques, electronic desk calculators are becoming more complex in calculation capability but cheaper in price. An example of the trend is the Sharp Compet 363P electronic calculator, which has the ability to perform programmed calculations of up to 144 steps with up to 16 digits. It is distributed in Australia by Sharp Corporation of Australia Pty Ltd.

The internal complexity of the Sharp 363P is so great that apart from listing the number of extra-large-scale integrated circuits (ELSI's) and memory registers (6 and 7, respectively), the manufacturers do not bother to list the number of LSI's, IC's, transistors and diodes. Frankly, after looking inside and seeing several very large printed boards literally swarming with epoxy-encapsulated dual in-line packages, we do not blame them.

Dimensions of the unit are $13\frac{3}{8}$(w) x $5\frac{3}{4}$(h) x $16\frac{1}{2}$ (d) inches and weight is 18.7lbs. The control panel has 32 push-button keys, 6 slide switches and 4 memory indicator lights. Behind the viewing window are no less than 19 neon numerical indicator tubes. The slot on the top of the case is for insertion of magnetic program cards. A rocker switch at the rear top of the case is the power switch.

Power requirements are 100 to 120V or 200 to 240V, 50 or 60Hz AC at 30 watts. Operating temperature range is 32 to 104 degrees Fahrenheit.

The numerical capacity of the 363P, both for inputs and the final result, is 16 digits, with up to 15 decimal places.

Basically, the 363P can be used as a conventional calculator or run to a program stored in its memory registers. In the former mode, it can be used for the following types of calculations: successive addition and subtraction, addition and subtraction by a constant, product ± product with individual products, quotient ± quotient, successive multiplication and division, power calculation, square root and successive square root.

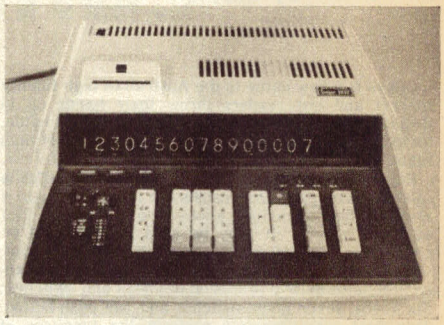
Typical speeds for average calculations are 0.05 seconds for additions and subtractions, 0.16 seconds for multiplications and 0.48 seconds for square root extraction.

Decimal places are automatically displayed and the number of decimal places in the calculation result may

**(Continued on page 102)**

## SHARP CALCULATOR . . .

be preset from zero to seven or left floating, ie, up to 15 decimal places. Where a number is approximated to a given number of decimal places, it may be rounded up, rounded off or the additional (unwanted) places discarded. Negative results are displayed with a minus sign.



*The Sharp Compet 363P electronic calculator with 16 of its 19 indicator tubes illuminated.*

The calculator is automatically cleared when first switched on so that entries may be recorded immediately. If an incorrect entry is made, it may be cleared without interupting the rest of the calculation by pressing the "clear entry" button.

All of the preceding remarks also apply to programmed operation. In this mode, the calculator performs complex routine calculations according to the stored program as soon as the required variables are entered and the "equals" button pressed. Programs may thus be used for rapid calculations such as surface area of a sphere, roots of a cubic equation, compound interest payments, solution of differential and integral equations. The programs may have up to 144 steps, which may if desired be split in two to form two supplementary programs. Each time a button is pressed in recording a program it constitutes one step. For example, the recording of the constant pi, 3.14159 requires seven steps.

The Sharp 363P has jump facilities available for programming. With this facility it is possible to repeat part of a program or to branch the program. Depending on which buttons are pressed after the "jump start" buttons, it is possible to make both conditional and unconditional jumps. In any one program there may be up to 8 conditional jumps and 6 unconditional jumps.

While programming is in progress, each step is displayed on the readout tubes. When complete the program may be checked and de-bugged by means of the check, de-bug, program correct and equals buttons. In the "check" mode, each program step is displayed sequentially just by pressing the "equal" button. If an error is found, the appropriate step can be corrected simply by pressing the "correct program" button and then pressing the correct entry.

Programs may be recorded on magnetic cards for re-use at any later date. Programs recorded on cards may be modified easily by re-entering into the calculator, by pressing the "enter" button and then using the "de-bug" and "correct program" keys. Correlation between programs stored in the machine and on cards is checked merely by pressing the "verify" button. If there is not exact correlation, an overload is indicated on the display.

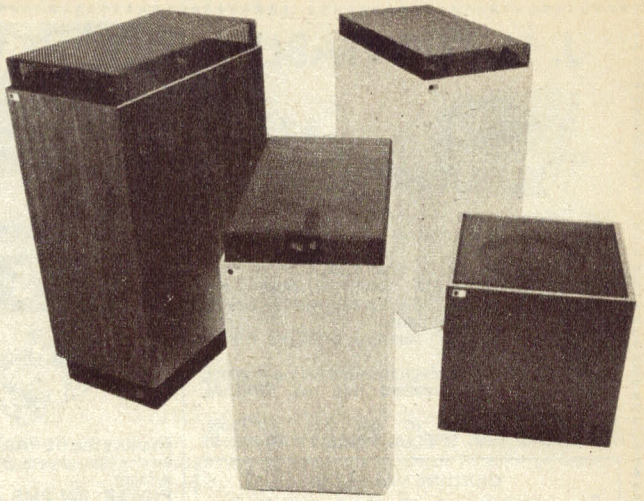
As with any machine of this complexity, familiarity with its full capabilities takes some time to acquire. With the 363P this time may perhaps tend to be a little longer than usual, not so much due to any shortcomings of the machine itself, but because of limitations in the guide manual. Admittedly there is a lot to explain about a machine of this type, but the 363P manual seems to leave the user to work out many of the fine details of machine operation for himself.

To summarise, the Sharp Compet 363P offers many of the features of a small computer but at a fraction of the cost. It is a delight to use and completely silent in operation. Recommended retail price of the 363P is $1300, including sales tax. This is very competitive with calculators offering similar facilities.

Further information on the Sharp line of electronic calculators may be obtained from the Australian distributors, Sharp Corporation of Australia Pty Ltd, 22 Burroughs Road, St Peters, NSW 2044. (L.D.S.)

THE SONAB PHILOSOPHY:

# WHO WANTS TO LISTEN TO A LOUDSPEAKER?



Perhaps more than any other high fidelity component, loudspeakers tend to have their own characteristic sound. Some have "presence", others sound "hollow". Some have a "powerful" bass, others "sparkle" at the top end. Some are "resonant", others by comparison are "dry". But who wants to listen to a loudspeaker? It's the music that matters!

The above sentiments come through very strongly in the views attributed to Stig Carlsson, the moving force behind the Sonab range of loudspeakers and other high fidelity components.

In Sweden, Sonab is a time-honoured name. In Australia it is less well known amongst a host of names from England, America, Japan, Denmark and elsewhere. But Sonab is now on the scene with a locally based subsidiary: Sonab of Sweden Pty Ltd, 114 Walker St, North Sydney 2062. The telephone number is 929-4288 or 929-4554. The new venture is under the guidance of Derek and Jackie Pugh, a young couple with a hi-fi background gained in the United Kingdom.

In his approach to loudspeaker assessment, Stig Carlsson has deliberately deviated from what is common practice — that of measuring the frequency response of a new loudspeaker in an anechoic room with a calibrated microphone placed carefully on the axis of the high frequency radiator.

Carlsson reasoned that while this approach might produce a system with a very level response on axis, as often as not it also resulted in a loudspeaker having very directional qualities. To use his illustration, when reproducing the sound of a violin, it imposes on that sound the false directional qualities of a trumpet!

Carlsson designed his first non-directional loudspeaker system about 20 years ago and he has stayed with the basic philosophy ever since. His aim has been to produce loudspeaker systems which specifically do not "squirt" a beam of sound towards the listener. He relies on reflection and reverberation in the listening room and aims for a condition where the frequency balance is as smooth as possible over the room as a whole.

Typical Sonab loudspeaker systems are illustrated at the top right. The line drawing, centre page, illustrates the internal structure and design of the OA-5 unit, which is intended to sell for about $450 per pair. It measures 17in wide x 9½in deep x 22¾in high.

The lower and middle register is handled by an 8in diameter twin-cone loudspeaker facing upward. Under the metal mesh top cover, it is protected by a muslin bag. The rear of the loudspeaker is enclosed by a layer of glass fibre, while two other generous layers of a similar material divide the cabinet into two chambers. The lower chamber has vents facing towards the floor and venting through an air slot between the main structure and the baseboard.

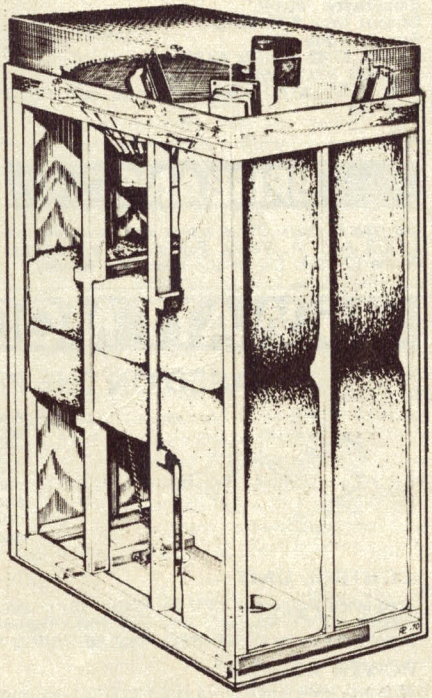
The heavy internal damping would certainly limit the reflex action of the enclosure so that it may well be more accurate to envisage it as a sealed enclosure with a designed amount of relief for back pressure. System resonance occurs at about 50Hz.

The upper register is handled by four tweeters with cones of approximately 1½in diameter, arranged on a pitch circle of 8in diameter and facing inwards and slightly upwards. When the system is placed in the corner of a room, only one tweeter radiates directly into the room space. The other three rely on bounce from the adjacent walls and corner.

An internal frequency dividing network provides for a crossover at a nominal 2700Hz. Roll-off for the bass speaker is 6dB per octave and, for the tweeters 12dB per octave.

Examined with sine-wave input, the OA-5 system sounds smooth over the range from 300Hz to 6KHz, though with a suggestion of colouration around 3KHz.

Above 6KHz, the level in a relatively hard room tends to rise towards a peak approaching 10KHz. In more absorbent surroundings, with less HF scatter evident, this might conceivably smooth down towards



*The Swedish lines of the Sonab range of loudspeaker systems will be evident from this photograph. Input connection is via a DIN socket mounted flush on what is intended to be the rear face of the cabinet. In other respects they are symmetrical.*

level overall but, in any case, it would be amenable to adjustment by the tone control.

Below 300Hz, the bass is sustained well down to 60Hz, with some prominence at the 50Hz resonance and a fairly rapid roll-off below that again.

Despite the use of a quite generous magnet structure on the main loudspeaker, efficiency is not particularly high and one gains the impression that it would be heard to best advantage with an amplifier having a power rating of around 30W RMS. At the same time, the maximum power rating is 40W RMS so that the OA-5 would probably not be the best choice for an enthusiast whose favourite obsession is shaking the floor with generous helpings of ponderous bass.

The OA-6 powered system would be the best choice from the Sonab range if this is the basic requirement.

On music the OA-5 is pleasant and relaxed in a typical listening situation, somewhat light-on in the extreme bass, but with the treble well enough dispersed as to discourage attention from the actual source of sound.

It would appear that Stig Carlsson has guided the styling to encourage visual as well as acoustic anonymity. With its rectangular body and dull-black perforated metal top the OA-5 is not an obvious loudspeaker system. At the same time, it can merge into a variety of settings, for which purpose it is available in a variety of finishes: teak, rosewood, oak, Scandinavian pine, walnut and white lacquer.

So there it is.

There are plenty of loudspeaker systems on the market which look exactly like loudspeaker systems — some even aggressively so.

There are plenty of loudspeaker systems which will rumble your floor with sheer bass power and produce a sound source so defined as to create a sharp stereo image in your favourite listening position.

Maybe you like it that way and you possibly have numbers on your side.

But Stig Carlsson (and Sonab) don't agree. Their aim is to produce a diffused, omni-directional sound source and, if you're worried about stereo image, you place the loudspeakers against the long wall of your room rather than the short one.

Stig Carlsson's approach won't appeal to all-comers but, if you're in the market for loudspeakers, the Sonab units are well worth evaluating on a personal choice basis against other more conventional types at similar price levels. (W.N.W.)

## ONKYO AMPLIFIER . . .

with only 6dB / octave slope — not enough to be really effective. RIAA phono compensation is within 1dB over the range from 50Hz to 15KHz and the signal overload margin is excellent. The basic sensitivity at 1KHz is 2.4mV but the maximum input signal for the rated distortion of 0.1 is 200mV. Similarly, at 10KHz, the maximum input signal is 1V before overload occurs.

Square wave response at frequencies up to 10KHz is very good, and stability with capacitances up to 1uF shunting the load is excellent. Signal-to-noise ratios for the phono inputs was -60dB with respect to 22W into 8 ohms, with inputs open circuit. With inputs short-circuited the figure improved to -70dB. For the high level input (100mV), the o c input signal-to-noise ratio was -80dB. Separation between channels was not quite so good but adequate at -33dB at 1KHz and -17dB at 10KHz, with the undriven channel input unloaded. The figures improve if the inputs are loaded. All the above S N ratios are unweighted, ie, they refer to wideband noise.

To sum up, it is very hard to find fault with the Onkyo 725. As far as control facilities are concerned, it would perhaps be better if it could handle two sets of loudspeakers imultaneously instead of a choice of two. But we had no real quibbles concerning its performance. It is ruggedly made and conservatively rated.

The Onkyo Model 725 is available from Miranda Stereo and Hi-fi Centre, Miranda Fair, NSW, at the retail price of $264 including sales tax. Onkyo amplifiers are distributed in Australia by Dodwell Trading Pty Ltd, 8 Glen St, Milsons Point, NSW 2061. (LDS).

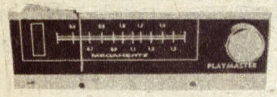
# J. H. TURNTABLE

**$39.50**

Belt Drive, Synchronous Moter, Rumble is not measurable. Wow & Flutter better than 0.04%. 12" Platter.
SPECIAL PRICE: $39.50 Post $1.00
**LUSTRE ST510D ARM:** Suited to above Turntable, this unit is PRECISION made with calibrated counter-weight adjustment.
Oil-Damped cueing lift supplied. SPECIAL PRICE: $26.50 Post 75c.
**AT66 CARTRIDGE:** Magnetic Cart with a tracking weight 1.5 — 3g. Excellent freq res. SPECIAL PRICE: $10.50.
**BASE:** Oiled Teak to suit J.H. T/Table. Professional finish. SPECIAL PRICE: $11.50 Post $2

**GENUINE VALUE . . .**
One complete set of above system inc T/Table, arm, cart, base **$85.00** Post **$3.00**

# PLAYMASTER 131 TUNER



**$23.50**
**Post 75c**

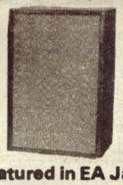
See EA, Feb, 71. IC Tuner with excellent Bandwidth, Selectivity & Sensitivity. Recommended for use with quality equipment.

# SCR SPEED CONTROL KIT

**$13.90**
**Post 75c**

Will vary speed of electric drills, electric saws, food mixers, movie projectors etc. etc. Gives a wide range of speeds while still maintaining good torque. Project described in May '71 EA Kit complete. Suitable to 750W motor.

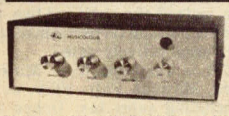
# MAGVAVOX 8/30 SPEAKER SYSTEM



**Featured in EA Jan '71**

Units available in oiled teak only. 1.6 cu ft system.
CABINET KIT: **$22.00***
CABINET BUILT: **$27.00***
COMPLETE SYSTEM inc all speakers & built cabinet: **$58.00***
AS ABOVE with kit **$45.00***
***FREIGHT:** All systems despatched by Rail or Road Transport, freight collected your end. Sorry, no C.O.D. on this line.

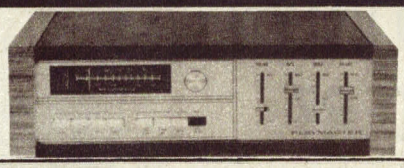
# MUSICOLOR MK II



**$49.75**
**Post $1.00**

New, updated display as described Dec '71. E.A. Full kit now available at special price **$49.75**

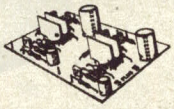
# PLAYMASTER 132 KIT SET



**POWER:** 40W R.M.S. per channel. Complete with tuner and professional specifications. See June-July, 1971, EA for more details. All parts new and guaranteed.

**$146.00**
**plus $2 Registered Post**

# 5 + 5 AMPLIFIER



Mono or Stereo

Employs the GE PA263 IC Kits are complete inc full instruction sheets & circuits. Makes an excellent system.
**POWER:** 5W RMS per Channel
**Freq Res:** 30 Hz — 100KHz
**Distortion:** Less than 0.6%
**Sensitivity:** 180mV.
**Output Imp:** 8-16 ohms
**Supply Volts:** 28V.
MONO: $7.85 WIRED: $8.85
STEREO: $15.50 WIRED: $17.50
Fully REGULATED power supply to suit $13.50 Post 75c

# BRISBANE

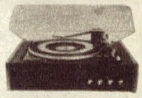
Our new Brisbane Office is now well established at 2/673 Ann St, Valley. Full stocks & services. Phone 52 8391. Call in and meet Bob Rowley.

# 60W GUITAR AMP

**$85.00**
**Post**
**$3.00**

Playmaster 117 unit as described EA, July, 67. Kit includes ALL parts to make up this quality guitar amp with many 'extras' — Bass & Treble boost, full Vibrato & Tone control circuits. At $85.00 this unit represents excellent value.

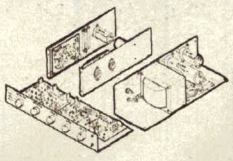
# NEW IC AMP KIT



An economical amplifier as described in EA, Jan, '72, we have made up a complete system that is outstanding value.
- Complete Amp Kit inc P/S; **$38.50**
- Oiled Teak Box to suit: **$11.50**
- BSR G11-105 AUTOMATIC T/Table to suit inc cer cart: **$29.50**
- Rola C8MX 8" Twin Cone Speaker **$8.50.**

# 45 WATT MODULE SYSTEMS

## BASED ON THE PLAYMASTER 132



A professional quality system offering flexibility and an economical solution to high quality amplifier system requirements. The circuits are based on the Playmaster 132 and the modules carry a guarantee that their performance will match the specification as listed by us and EA. Simple to construct with step by step instruction Booklet included. The system consists of 4 units, each individually obtainable.

### CONTROL UNIT:—

Frequency Response: 18Hz to 45KHz. Distortion: 0.05% THD (400 mV). 3 Input Facilities: Aux — 500mV, (100K). Magnetic 3mV (50K RIAA Response). Ceramic 60mV (2m). Includes chassis, front panel, pots, knobs etc **STEREO — $31.50. WIRED & TESTED — $41.50.**

### POWER AMPS.

45 Watts RMS into 8 ohms at 0.1% THD Frequency Response — 10Hz to 65KHz. Sensitivity — 400mV (150K). Damping Factor — 56 with 8 ohms. All Silicon Circuitry.
MONO **$19.50.** WIRED & TESTED **$24.50.**
STEREO **$39.00.** WIRED & TESTED **$49.00.**

### POWER SUPPLY.

60 Volts at 2 Amps. Cont, Regulated with Variable Output/Speaker Protection. Electrolytics included. **$30.50.** WIRED AND TESTED **$35.50.**

**ALL PARTS NEW AND GUARANTEED**
**INFORMATION BROCHURE AVAILABLE.**

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**ORDER FORMS:** Sent free with each order.
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**PHONE SERVICE:** Simply order on phone and order will be despatched C.O.D. within the hour.

**QUALITY:** All our parts are new and fully guaranteed. No surplus or rejects.

**CATALOGUE:** Now available price 50c.

# KIT-SETS AUST. PTY. LTD.

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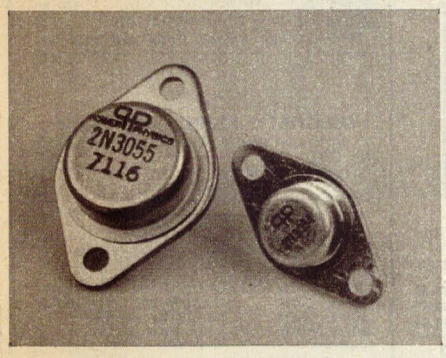
SYDNEY SALES DEPT: SUITE 2, 21 OAKS AVE., DEE WHY, 2099. PHONE: 982-5571.
BRISBANE SALES DEPT: 2/673 ANN STREET, FORTITUDE VALLEY. PHONE: 52-8391.
TRADING HOURS: Mon-Fri: 8 A.M.-5.30 P.M.; Sat: 8 A.M.-12 Noon.

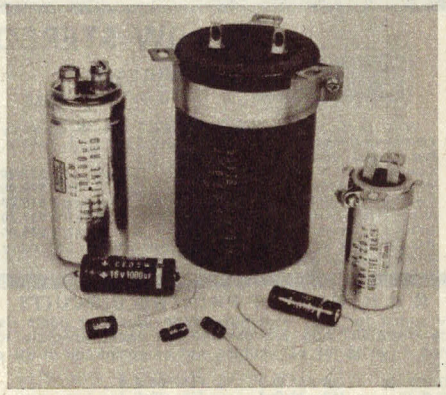
# Components from Hawker Siddeley

Pictured are some of the components from the large range stocked by Hawker Siddeley Electronics Ltd. The range includes LED's from Monsanto, power transistors from Power Physics, Shizuki polyester capacitors and electrolytic capacitors from Nippon Chemi-con.

Light-emitting diodes from Monsanto were reviewed in these pages last month. Since then, more LED's have been added to the range and some have dropped in price. The line-up of electrolytic capacitors, some of




which are pictured, ranges in size from the 8000uF / 75VW unit which has a high ripple rating to the miniature 100uF / 6.3VW printed board mounting type.



Power Physics semiconductors include the much used power transistors, 2N3055 and 2N3054 and these are available at competitive prices.

All components may be obtained by ordering through trade houses or direct from Hawker Siddeley Electronics Ltd, 752 Pittwater Road, Brookvale, NSW 2100.

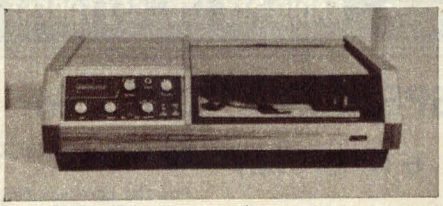
# Stereo Equipment from Audiosound

Audiosound Electronic Services have announced details of their "unit-audio" systems based on their LD 30 stereo amplifier and Audiosound loudspeakers.

The basic "unit audio" system uses the LD 30 solid state stereo amplifier which has a continuous power rating of 30 watts per channel for less than 0.08% total harmonic distortion at 1KHz. Loudspeakers used are the Audiosound "Prague II" which were reviewed in these columns in August, 1971.

For the record player, there is a choice between Dual or Garrard units, including the Garrard Zero 100. The cartridge may be an ADC 220XE, Pickering AC2 or XV15/750E. As the systems are manufactured in Australia, the record player attracts little or no import duty, so that prices can be held to a minimum.

Options include the LD 30 with "simulated quadraphonic" facility, the Audiosound AM100 Mark II broadcast tuner which was reviewed in these columns



and other loudspeakers in the Audiosound range.

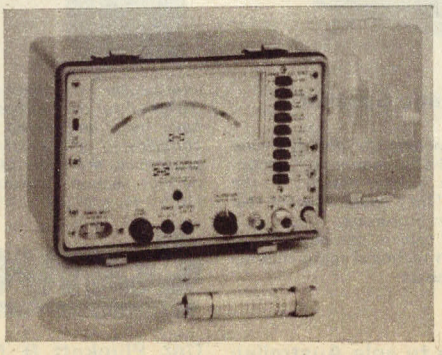
Two cabinet styles are available. The first uses a separate timber case for the amplifier and a timber plinth with hinged plexiglass cover for the record player. The second has the amplifier and record player in compact cabinet with aluminium trim and sloping front panel for the amplifier. This cabinet is shown in the photograph. Prices for complete systems start from $449.

Further details can be obtained direct from Audiosound Electronic Services, 35 Heather Street, Collaroy Plateau, NSW 2098.

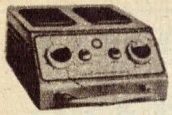
# TRADE RELEASES ... in brief

**R. H. CUNNINGHAM PTY LTD**, GPO Box 4533, Melbourne, 3001. Agent for Kilovac Corp, USA. **Vacuum relay**, type KC-10. This is a rugged spdt vacuum relay capable of withstanding a voltage of 15KV DC or 60Hz peak, and of carrying a current of 75A DC or 60Hz RMS. It uses the latest in metal-ceramic design technology and is suitable for use under severe environmental conditions. Normal operating voltage for the standard 225 ohm coil is 26.5V DC.

**TECNICO ELECTRONICS**, PO Box 12, Marrickville, NSW 2204. Agent for Pacific Measurements Inc, USA. **Microwave powere meters**, models 1034 and 1035. These "truly-portable" instruments are designed specifically for use with communications links and CATV systems, but are also useful in factory and laboratory work. They measure both 50-ohm and 75-ohm systems. The two models are identical except for a 10dB offset in overall power measuring range. The 1034 measures from less than 10nW to 10mW; the 1035 from less than 100nW to 100mW. Power can be



measured in five 10dB ranges or using a single 50dB range. The frequency coverage is from 1MHz to 14GHz. Rated accuracy is 1% of full scale or 1.5% of reading on all but the two most sensitive ranges.



**New All Silicon 30 / 60W PA PORTABLE AMPLIFIER**

12-16V, two inputs, 5mV and 100mV. Dimensions 6½in W x 3¼in H x 8½in D. 15-ohm output, No 763D, **$62.** For 125, 250, 500-ohm output, No 763A, **$64.** For 240V operation $33 extra.
10W PA amplifier similar to above, 4-ohm output, 240V operation, No 729D, **$40.** Freight extra.

**CD IGNITION COIL**

For EA (Fraser) circuit. Mounted on strong fibreglass printed circuit coded for all other components. Polyester film layer insulation. Connected and tested. For standard distributor, No 787; for photo cell distributor, No 786. **$8 each. Postage 20c each.**

**R.C.S. COMPLETE DO-IT-YOURSELF KITS**

Peak reception. Low price. No expensive test equipment. Everything fits. 1964 RF Transporta 7.

Complete kit — No 640 **$43.50**
Portable car radio. Identical to 640 above, plus extra switch and car coil, etc. No. 642 **$46.00**
**Postage $1.**
(Write for booklet on 640 and 642.)

**NEW TRANSISTOR PREAMP KIT**

SIZE 3 x 2 x 1in, 2 req. for stereo.

| | |
|---|---|
| LOW IMP input, 2 trans, 672C | $6.50 |
| Wired ready for use, 672D | $8.00 |
| HIGH IMP, 2 trans, 680C | $6.50 |
| Wired ready for use, 680D | $8.00 |
| HIGH IMP silicon, 3 trans, 682C | $8.00 |
| Wired ready for use, 682D | $9.50 |

**Postage 10c each. Write for data.**

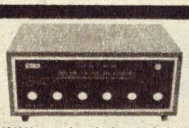
**COILS and IFs 455KHz**

| | |
|---|---|
| Aerial, RF, Osc and IFs | $2.00 |
| Ferrite aerial | $2.40 |
| No. 265 Universal tape Osc coil | $6.00 |

**Postage 10c. Write for details and price.**

**HI-FI BROADCAST TUNER UNIT 4 TRANSISTORS—HIGH SENSITIVITY**

RF mixer, IF, power detector stages, adjustable aerial coupling. Complete as illust, wired and tested with 461 dial, knobs and switch pot, No. 474D, **$31. Freight extra.**
**WHISTLE FILTER** for above set for 8KHz bandwidth. (Can be altered to 9, 10 or 11KHz.) No. 128, **$4. Post 10c.**



**10W STEREO**
**MULLARD 10 + 10W RMS**

With output transistor PROTECTION. Frequency response 40Hz to 30KHz. Distortion 0.5 per cent. Treble, bass boost, 20dB.

| | |
|---|---|
| Complete kit of parts, No. 480C | $74.00 |
| Wired and tested, No. 408D | $79.00 |
| Cabinet as illustrated | extra $10.00 |
| Magnetic pickup preamp, No. 762D | extra $11.50 |
| Inbuilt BC tuner with w / filter | extra $35.00 |

Plus freight. Write for brochure. For special Saturday demo, ring 59 6550.

**R & H, EA & ET PRINTED CIRCUITS**

Clearly coded for easy assembly. With blueprint parts list. Immediate dispatch. Add 20c postage for each. Specials to your drawings — write for particulars and blueprint list of all printed circuits.

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| 683—64.A.9 | 711—67.A.4 |
| 678—65.O.9 | 723—68.5.T |
| 679—65.M.9 | 731—68.M.12 |
| 684—65.P.10 | 736—69.5.T |
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| 686—65.P.12B | 758—10.P.1 |
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Tap 6V and 9V at 100mA. Filter capacitors, rectifier, resistor, etc. **$6.50. Post 20c.**

**NEW STEREO MAGNETIC PREAMP**

Hum free, 5mV input, 250mV out. Size 3 in x 2in x 1in. Wired ready for use. No. 762D. **$11.50. Post 10c.**

**NOISE FILTER**
**for radio and TV**

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In 5mV, out 250mV. Bass and treble 20dB.

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**NEW BASS BOOST**
**4-TRANSISTOR STEREO AMP**

**Unity Gain:**
400Hz, 0dB
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Connect between your preamp and main amp. No. 791D, **$10.80.**
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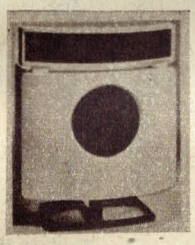
# B & W 'MONITOR' SPEAKERS

## There's a MONITOR Speaker by B. & W. for every purpose and pocket.

Clement Brown writing in "Hi-Fi Sound" says, *"What is MONITOR class? Use of this term implies all sorts of things — smooth extended frequency response, superior power handling capacity, low distortion . . . a truthful loudspeaker . . . which will gain the approval of professional users, B. & W. present professional quality in a format that will meet domestic requirements."*



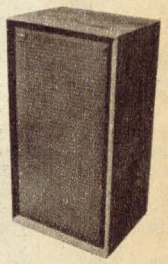
**B. & W. Model 70 MONITOR Electrostatic Speaker.**

For the ultimate Perfectionist, $536. each *". . . approaching the ideal everyone is seeking — perfection".* writes Mr. John Gilbert in the Gramophone, London. *"I was really astounded . . . a major breakthrough in Speaker design . . . the new models don't sound like loudspeakers at all." "They sound like the real thing,"* says distinguished English Music critic John Freestone.
The B. & W. 70's are also available in kit form, and cabinet can be made to special designs or built in. Convoy experts advise on technical requirements. For Amplifiers over 30 watts RMS 8 ohms, up to 100 watts.

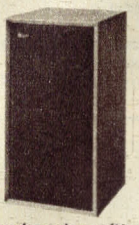
**Limited shipments now available. Write to sole Australian Agents for further information about your nearest B. & W. Monitor Speaker supplier.**

# ONLY for the DISCRIMINATING

**B. & W. Model DM3-72 MONITOR 3-way**



For the compact Perfectionist (2 cu.ft.) $285. each. *"The DM3 is a loudspeaker design worthy of the name monitor, we heartily commend it. Many words could be written in an attempt to convey an idea of the speaker's merits as a musical instrument,"* says Clement Brown in "Hi-Fi Sound", . . . *"Monitoring quality is truthful quality".* David Philips and Donald Aldous in "Audio Record Review" say . . . *"the response is clean and smooth, indeed amongst the smoothest we have heard from a loudspeaker."*



**B. & W. Model DM1-72 MONITOR 3-way.**

For the mini-space Perfectionist (0.65 cu.ft.) $139. each. An improved, new version of the famous DM1 superseding previous models. Mr. H. W. Hellyer says in "Popular Hi-Fi", *"Why should the DM1, despite it's volume . . . give such a superior performance? Firstly, because this is a three-unit loudspeaker with elliptical bass 'woofer', round mid and high unit and a super 'tweeter' for the topmost frequencies. Secondly, because the crossover units have been engineered to no-compromise standards making them more complicated and costly and finally because of the most stringent test procedures are undertaken at B. & W.s Worthing headquarters."* This is the perfect 'second' speaker for offices, dens, patios, boats, cars or bookshelves (16½" H. x 9" W. x 8" D.).

**Convoy Imports**
A Division of Convoy International Pty. Ltd.

**Cnr. Plunkett & Maclean Sts., Woolloomooloo. 2011. Sydney, Australia. Phone (02) 357-2444. Cables & Telegrams 'Convoy Sydney'.**

## TRADE BRIEFS

**SCHLUMBERGER INSTRUMENTATION AUST PTY LTD**, PO Box 138, Kew, Vic 3101. **Double beam oscilloscope**, model OCT749R. This is a high-gain instrument designed specifically for the measurement and display of low level signals encountered in biological and mechanical engineering. Differential or single ended inputs can be applied using either an internal time base or an external signal applied to the X amplifer. The vertical amplifiers can be cascaded to give a single beam sensitivity of up to 2uV / cm, due to extremely low noise levels inherent in the amplifiers.

**RACAL ELECTRONICS PTY LTD**, 47 Talavera Road. North Ryde, NSW 2113. Agent for Racal Instruments Ltd, UK. **Frequency-period meter**, model 9024. Designed primarily for use as a precision communications test instrument in the UHF and TV bands, this unit has a direct reading frequency range from 10Hz to over 600MHz with a sensitivity of better than 10mV up to 500MHz. The instrument has an 8-digit, latched, in-line display plus flow indication.

**PLESSEY DUCON PTY LTD**, PO Box 2, Villawood, NSW 2163. **Zero tracking error turntable**, Garrard model Zero-100. This tangential auto-transcription turntable, which is also available in a single play version, is now available in Australia. It incorporates a zero-tracking error pickup arm which has won Garrard awards in the USA and Italy. (A description of the arm appeared in "Electronics Australia", July 1971, page 87.) The principle features are: cartridge housing pivoted directly above stylus tip; degree of pivot controlled by auxiliary articulating arm; facility for vertical adjustment of stylus tracking angle; clear acrylic gauge for accurate alignment of cartridge; extremely accurate stylus force adjustment; magnetic bias compensation control; variable speed control, ±3%.

**PHILIPS INDUSTRIES LTD**, GPO Box 2703, Sydney, 2001. **Electronic burglar alarm**, model LHD 1100. Containing a transmitter receiver, power supply and alarm in one compact, portable unit, the alarm protects an area of 150sq ft on its own and an area of up to 300sq ft using transducer strips. The alarm uses a piezoelectric transducer to radiate an ultrasonic frequency. When an object moves in the radiated field, the movement is detected by the unit and the alarm is sounded. The unit is suitable for battery or mains operation, and automatically switches to battery in the event of mains failure. The alarm can only be switched off by punching numbered buttons in their correct sequence.

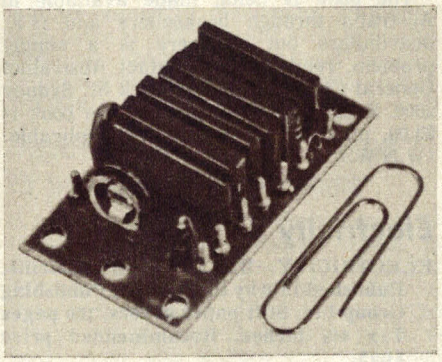
**FAIRCHILD AUST PTY LTD**, PO Box 151, Croydon, Vic 3136. **Schottky TTL / SSI devices**, 9S series. Eight second-source, super high speed devices have been designed as pin for pin replacements for 54 / 74 and 9N series standard TTL / SSI units. Features include: gate propagation delay, 3ns typical; power dissipation pergate, 22mW typical; high noise margin and fanout (more than 10TTL unit loads); completely compatible with other TTL products.

**DAVIS-FULLER ADHESIVES PTY LTD**, PO Box 169, Botany, NSW 2019. **Epoxy adhesive**, type Clear Resiweld. This is completely colourless, does not turn yellow on curing, and is suitable for the repair of china, etc, where the colour of the bond could be detected. It is suitable for all general bonding of dissimilar materials, such as glass, timber, stone, etc. It cures to a full epoxy strength of 2000psi. To demonstrate the


product, Davis-Fuller chemists have bonded together two clear pieces of glass through which newsprint can be read without distortion or blurring (see picture).

**HEWLETT-PACKARD AUST PTY LTD**, 22-26 Weir St, Glen Iris, Vic 3146. **Schottky diodes**, type 5082-2835. This device has a lower turn-on voltage than other silicon diodes. At a forward current of 1mA, the junction voltage is only 340mA, compared with 700mA for conventional silicon PN junction diodes and 410mV for earlier Hewlett-Packard Schottky diodes. This turn-on voltage is comparable with that of germanium diodes, but the new diode has much better temperature characteristics (operating range -55 to +125°C) than germanium diodes. Other characteristics include: fast recovery time, less than 100ps; junction capacitance 1pF at 1MHz and zero bias; breakdown voltage 5V.

**ALPHA ELECTRONIC SERVICES INC**, 8431 Monroe Avenue, Stanton, Calif 90680, USA. **Encoder-decoder**, model SS-80J. This miniature device uses tones in the range 20Hz to 250Hz to make possible more efficient use of two-way radios by requiring that transmissions to a base station or mobile radio be accompanied by a predetermined tone to activate that receiver. Thus the user does not need to listen to noise,



interference and conversations of other users sharing the carrier frequency. Each SS-80J contains a tone frequency determining network which can be removed and changed when desired. Composed of thick film hybrid chips, the unit is small enough to be used in portable and hand-held radios. No mechanical reeds or relays are employed.

**SIXTEEN MILLIMETRE AUST PTY LTD**, GPO Box 4778, Sydney, 2001. Agent for Shiba Electric Co Ltd, Japan. **Colour TV camera**, Shibaden model FPC-1000. The design uses proven TV broadcast techniques with features important to users of studio TV equipment. Simplified set-up procedures allow the camera to be put on the air with a minimum of adjustments. Features include: dichroic mirror optical system; three separate mesh vidicon tubes; parallel configuration of vidicons; automatic iris control; easy white balance adjustment; built-in encoder; self contained interlace sync system; built-in colour bar generator; selectable colour temperature compensation filters; removable electronic viewfinder; intercom between camera operator and director; provided with 20-100mm f1.8 5X zoom lens; any C mount lens may be used.

**ENGLISH ELECTRIC VALVE CO LTD**, UK, has announced that its CX1157 tetrode hydrogen thyratrons are being used in thyratron switching units made by Hivotronic Ltd for applications such as driving spark chambers for detecting nuclear particles. The units offer the advantages of long life, high triggering rates, wide range of operating voltage, low trigger power, and extremely low jitter for precise positioning and firing of pulses. The CX1157 has a ceramic envelope, is compact and ruggedly constructed, and its coaxial geometry allows it to be mounted in a transmission line structure to take advantage of its inherently low inductance. Inquiries to GEC-Elliott Automation Pty Ltd, Electronics Division, 15 Whiting Street, Artarmon, NSW 2064.

**FAIRCHILD AUSTRALIA PTY LTD**, PO Box 151, Croydon, Vic 3136, has been appointed distributor for General Electric Co, USA, semiconductor products in NSW and Victoria. Products stocked by Fairchild include triacs, SCRs and trigger devices. Product assistance and information is available from Fairchild offices in both states.

**IDM ELECTRONICS LTD**, Systems Division, Arkwright Rd., Reading, Berks RG2 OLH, England, is seeking agents in Australia for its wide range of equipment. Products manufactured by the division include TS and MS low level scanning units (which feature a new approach towards reducing the overall cost of precision low level multiplexing) and a range of automatic test systems (which provide completely automatic insulation and breakdown testing). The division has also developed a new digital program timer for controlling small process systems and experiments.

# BOOKS & LITERATURE

## Experimental circuits

**ELECTRONICS EXPERIMENTERS CIRCUIT MANUAL. Third edition, 1971, published by the General Electric Company, USA. Stiff paper cover, 252 pages 8½ x 5-¼ inches.**

Here's a book to whet the appetite of any keen electronics experimenter. Compiled by the Advertising and Promotions section of one of America's big tube and transistor manufacturers, the material could be expected to be on a better technical footing than some other books we have seen relying on the number of circuits rather than the quality of the information.

Here the number of projects may not be as great but they have an air of utility rather than futility and there is also a useful amount of explanatory text about each: what they are supposed to do, how they work and how they are adjusted.

There are 10 projects relating to automobiles: flashers, a theft alarm, a tacho, CDI ignition, &c.

Five projects relate to electronics and hobbies; dancing lights, model rail control, electronic dice, phototimer and a slave photoflash.

Another sixteen projects apply electronics around the home and camp: a night light, a lamp dimmer, a time delay relay &c.

The remaining ten have to do with the electronics workshop itself, in the way of power supplies, heat controller, meter protection &c.

As a bonus, some 47 pages at the front of the book deal with basic theory and the kind of components which feature in the projects.

While the components are naturally those drawn from the G.E. range, the information and the ideas should increase the chances of finding and adapting substitutes, should this prove necessary. With those devices operating directly in mains circuits, there will be the additional responsibility of deciding whether components and ideas can work at 240 rather than 115VAC. In short, the book would be better suited to the more mature experimenter than to the beginner.

The book is being made available in Australia through booksellers and G.E. distributors but, if there is a supply problem, readers may contact Australian General Electric Ltd, 103 York St, Sydney 2000. Suggested retail price of the book is $3.00, plus 40c postage where applicable. (W.N.W.)



## Electricity

**ELECTRICITY. BY D. R. G. Melville. Published 1970 by the Hamlyn Publishing Group Ltd. Stiff paper covers, 160 pages 7 x 4¼ inches. Recommended price $1.75.**

Here's another one of those very well produced Hamlyn paperbacks. Written by an author who is a qualified and experienced electrical engineer, the book is easy to read, illustrated on every spread by full-colour diagrams and sketches, and packed with information.

Beginning in historical vein, it looks at magnetism, electricity itself, electrical measurements and modern power generation.

Succeeding chapters deal with power transmission, electricity in industry and transportation, and electricity in the home.

Finally, the author takes a peep at likely future developments: magneto-hydrodynamics, superconductors, "wireless" power transmission and linear motor transportation.

In short, it is an easy-to-assimilate paperback for the technically inclined reader who needs a change from whodunits and protest. (W.N.W.)

## Listeners' guide

**1972 WORLD RADIO AND TELEVISION HANDBOOK, 26th Edition. Edited by J. M. Frost. Published by World Radio and Television Handbook Co Ltd, Soliljevej 44, 2650 Hvidovre, Denmark.**

In the 25 years of its publication, this annual handbook has become indispensable for the serious short-wave listener. The 26th edition has 384 pages crammed full of information on radio and television stations throughout the world. Stations are listed both under geographical location and frequency. In addition to this basic information, there are articles about reception conditions in 1972, listings of news bulletins in English, local time around the world, numbers of radio sets in use in different countries, maps, and other useful material.

The claim of the handbook to be "A complete directory to international radio and television" cannot be disputed. Once again the listings have been as up-to-date as it is possible to be at the time of going to press. Compared with last year's handbook, the expansion of broadcasting activities in some countries is obvious, as can be seen by the longer lists of stations in the Philippines and Brazil in particular. This reviewer had the opportunity to visit the publishers in Denmark during a world tour, and is fully conscious of the tremendous task involved in preparing each issue. One could not fail to be impressed by the care and attention to detail, to ensure the accuracy of the information published.

The 1972 World Radio and Television Handbook is available from book stores in Australia, and in New Zealand from the sole Agent, Arthur Cushen, 212 Earn Street, Invercargill. A free brochure is available on request. (A.C.)

A copy of the "World Radio & TV Handbook" was also received from Technical Book and Magazine Co Pty Ltd, 289-299 Swanston Street, Melbourne, 3000, from whom copies are available. The Australian price is $5.95 plus 50c postage in Victoria or 65c interstate.

## Hi-fi yearbook

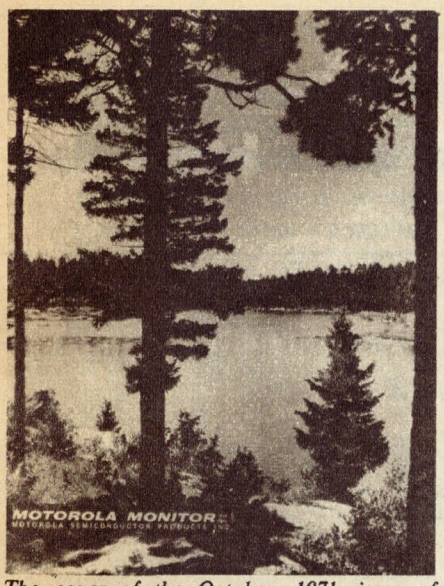
**HI-FI YEARBOOK 1972, edited by Colin Sproxton. Published by IPC Electrical-Electronic Year Books Ltd, London. Hard covers, 376 pages, 8½ x 5in, illustrated. Price in Australia $3.90, postage 50c Vic., 70c other states.**

The format and styling of this annual directory of audio and related equipment available on the UK market continues as in previous years. There is the usual series of short articles at the front, intended for the guidance of users of audio equipment, the titles this year being: Principles of the Dolby Noise Reduction System, by Donald Aldous — Hi-Fi From FM Radio, by Gordon J. King — Demonstration Discs, by W. A. Chislett — Meaning and Importance of Pickup Parameters, by John Earl — Microphones A to Z, by Donald Aldous.

However, the articles are of only secondary interest, the main value of the book being in the directory sections, which cover the whole field of domestic audio equipment, including kits as well as ready made units. Brief specifications are given of all items listed, with current UK prices and names and addresses of manufacturers or importers.

The practice of making innovations to the directory section to make it easier to use continues with this current edition. Last year, the brand names were given more prominence to make them stand out more. This year they are even easier to locate, as a bold black marker precedes each name. Another innovation this year is the provision of a separate alphabetical index giving names, addresses and telephone numbers of manufacturers and importers — although this is largely of academic interest to the Australian buyer.

The high standard of presentation of previous years has been maintained. The book is solidly bound with hard covers faced with a linen type material, and the good quality glossy paper has resulted in sharply defined, easy to read printing. At its modest price of $3.50, the volume must be regarded as something of a bargain, despite its limited usefulness in Australia.




*The cover of the October, 1971, issue of "Motorola Monitor". This is a special issue devoted entirely to the subject of MOS technology. Copies are available to inquirers writing under company letterhead to Motorola Aust Pty Ltd, 37-43 Alexander Street, Crows Nest, NSW 2065.*

Our review copy came from Technical Book and Magazine Company, 289-299 Swanston Street. Melbourne, Victoria 3000. (H.A.T.)

## LITERATURE — in brief

**STANDARDS ASSOCIATION OF AUSTRALIA**, 80 Arthur Street, North Sydney, NSW 2060, has published the following new Australian standards. Copies may be obtained from the various offices of the association in all capital cities and Newcastle for the prices noted.

AS 1099, 2nd issue. A series of additional tests for establishing the durability of electronic components and equipment under various extremes of use, storage and transport including: damp heat (12 plus 12 hour cycle), bump, drop and topple, free fall, acceleration-steady state, normal storage, low temperature storage, and mould growth. Price $3.20. The first group of methods is available for $5.

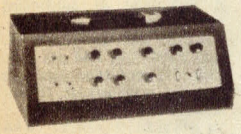
AS 1173. Recommended methods of measurement on receivers for television broadcast transmissions. It describes methods of measuring the electrical, acoustic and optical properties of TV monochrome receivers, of either negative or positive modulation, and the associated sound channel. Price $10.80.

AS 1174, Part 1. General conditions of measurement, frequency output power and power consumption of radio transmitters. Part 2. Bandwidth, out-of-band power and power of non-essential oscillations of radio transmitters. These standards describe methods of measurement for ascertaining the performance of a radio transmitter together with the conditions under which the test is performed. Price: Part 1, $29.15; Part 2, $38.25.

**GENERAL ELECTRIC COMPANY**, USA, has published a 28-page catalogue describing the company's ballasts for fluorescent lamps. In addition to tables of ratings and other data, the catalogue gives general information on ballasts including installation and operating instructions, and dimming systems. Inquiries, on company letterhead, should be addressed to Australin General Electric Pty Ltd, 103 York Street, Sydney, 2000.

**HEWLETT-PACKARD JOURNAL**, Vol 23, No 3, November, 1971. Published by Hewlett-Packard Co, USA. Contents: A scrutable sampling oscilloscope; Frequency stability measurements by computing counter system; More informative impedance measurements, swept from 0.5 to 110MHz; New UTC system; Time step and elimination of the frequency offset of the UTC system. Inquiries to Hewlett-Packard Aust Pty Ltd, 22-26 Weir Street, Glen Iris, Vic 3146.

## 50 WATT SOLID STATE GUITAR AMPLIFIER



50 watts RMS. solid-state guitar amplifier PM125 4 inputs, 2 channel with separate volume, bass and treble controls; speed and intensity controls for vibrato. Remote foot switch with plug and lead. Black vynex carry cabinet. Kit of parts **$98.00**
Fully constructed and ready for operation off 240VAC **$114.00**

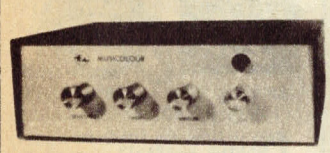
## AUTO-RHYTHM UNIT

Very latest model with cancel controls, 240 volt operation, high and low impedance output, 28" x 3½" x 10½", weight 13 pounds. 16 rhythms: Rhumba, beguine, cha cha, mambo, samba, bossa nova, rock'n roll, slowrock, western, waltz, tanga, swing, jazz, shuffle, foxtrot, and march.

Also 9 instrument sounds: cymbal, brush, snare rimshot, clave, bongo, hiconga, loconga, bass.

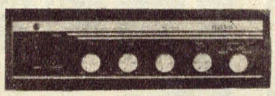
Controls: tempo, volume, stop, start, sustain, cancel for three instruments. Complete with remote foot switch, audio cable and instruction book. **$179.00**

## MUSICOLOUR II



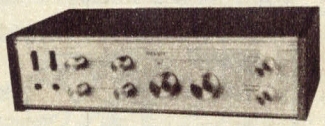
As per E.A. Dec. '71, Jan. '72. Complete
Kits of parts **$49.50**
Fully constructed **$59.50**
Pack & post **75c**
P.C. BOARD ONLY **$3.25**
SPECIFIED TRANSFORMER ONLY **$4.35**

## ALL SILICON TRANSISTOR SOLID STATE STEREO AMPLIFIER



240V AC powered, 8 watts RMS per channel inputs for magnetic ceramic, and crystal cartridge, also recorder and radio tuner. HI-Fi frequency response speaker matching 4-16 ohms. Size 10½ in x 6½in x 3½in. Attractive oiled teak cabinet.

**$54.00**



## SONATA NS-1600D

All silicon solid-state Hi-Fi Stereo Amplifier. 10 watts RMS per channel. Each channel has separate Bass / Treble controls. Inputs for magnetic or ceramic cartridge, crystal mic., radio, tape — tape out, stereo headphones. 8 — 16 ohms. Instruction booklet, circuit supplied. Timber cabinet. Dimensions: 14½" x 8" x 4". Price **$67.50**. Pack and Post $1.50. Interstate $2.50.

## HI-FI STEREO HEAD PHONES

Freq. 20-12000 Hz
Imp. 8 ohms
Complete with lead and standard stereo phone plug.

**$5.25**
Pack and post 35c

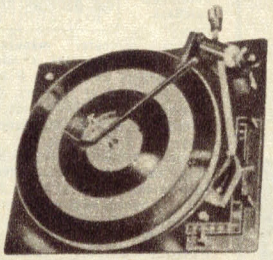
## MAGNETIC CARTRIDGE

Response: 15Hz — 25000Hz
Output: 9mV
Diamond Stylus.
Tracking weight: 1-2.5 grams

**$9.60**

## STEREO RECORD CHANGERS

C129-- C141 — C142 — C142A3



Current models, 4 speeds, automatic or manual operation.
Standard model **$28.50**
Ceramic cartridge, Sapphire stylus.
Standard model with 12in turntable **$34.00**
Deluxe model with 12in turntable, Cueing device, ceramic cartridge, diamond stylus **$40.00**
Deluxe model as above with adjustable counter balance, 2 spindles, calibrated stylus pressure control added **$46.50**
Deluxe model as above with 12in Diecast Heavyweight turntable, 4-pole shielded motor, sutiable for Magnetic cartridge **$56.50**

The latter two record-changers can be supplied with magnetic cartridge and diamond stylus at $10 extra

## B.S.R. STEREO RECORD PLAYER

Latest design. 4-speed. Auto or manual operation. 11" heavyweight diecast turntable driven by fully shielded 4-pole dynamically balanced 240V motor. Noise suppressor. Silicone damped cueing device. Square section brushed aluminium pickup arm. Adjustable counterbalance. Calibrated stylus pressure control. Antiskate bias compensator fitted with magnetic cartridge. Diamond stylus.

**$62.50**
Pack and post $1.50

## CHANGER AND PLAYER PLATFORMS

Teak. Cut out to suit C109-MA65-MA70-MA75 **$9.00**
Fully moulded tinted perspex cover, 17¼in x 13½in x 4in **$9.00**

**$9.00**

## STEREO RECORD PLAYER

240V AC — 4 speeds, ceramic cartridge. Separate motor, 7in turntable, pickup arm and rest. Post 50c.

**$7.90**

Mounting platform available, **$5.50**. Post 40c.

## Rotating Distress Emergency Beam

Red, Blue, Amber
Visibility ½ mile.
12V DC operation. Waterproof. Complete with heavy duty suction Cap. Size 3½in. dia. x 5½in.

**$5.75.**
Pack and Post. 35c

## GARRARD STEREO RECORD PLAYER

3 Speeds, Auto-Stop Sonatone HiFi Ceramic Cartridge Included.
**$15.50**

Pack and Post NSW $1.00.
Pack and Post Interstate $1.50.

## MAGNAVOX WIDE RANGE TWIN-CONE SPEAKERS

8-16 ohms
30-16000 Hz.
6WR MK5 12-W RMS **$ 9.90**
8WR MK5 16-W RMS **$10.75**
10WR MK5 16-W RMS **$11.50**
12WR MK5 16-W RMS **$12.50**

Pack and Post 65c.
Send SAE for Data Sheet.

## SINCLAIR INTEGRATED HI-FI AMPLIFIER

Z30 20 Watts **$12.00**
Z50 40 Watts **$14.50**

All Instructions and Circuits Supplied.
Pack and Post 50c.

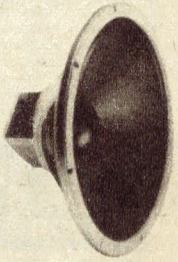
## TAPE CASSETTES

Tensilised Mylar Supplied with Plastic Pack.
C60 **95c**
C90 **$1.80**
Head Cleaner **$1.70**
Post 10c

Special. American Robbins Tensilised Mylar.
7" 2400 FT. **$5.50**
Post 25c

## TOP QUALITY AUST. MADE SPEAKERS

12in Wooter 20 watts RMS **$24.25**
12in Wooter 15 watts RMS **$22.00**
12in Twin-cone 15 watts RMS **$19.00**



## 15" PIONEER

15in Pioneer low frequency speaker, Imp. 8 ohms. Power, 30 watts, RMS designed especially for use with bass guitar or electric organ. Also ideal for stereo woofer speaker.

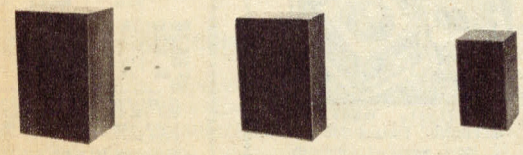
**$33.00**

## ROLA 50 WATTS RMS

**(Special purchase)**
Model 12U50 12inch

24Hz — 11KHz 8 or 16 ohms **$35.00**
12UX50 12inch hi-fi extended frequency **$42.00**

# SPEAKER ENCLOSURES



**NEW MAGNOVOX 8.30 SYSTEM**
Ref. Jan. '71 E.A.
1.6 C.F.T. 30 watt. 8.6 ohms.
Complete ready for use.
**$60.00 ea.**
8-30 speaker only **$18.50**
3TC Tweeter only **$3.75**
Cabinet only **$30.00**

**HI-FI SYSTEM with 8WR MKV and 3UC tweeter**
16 watts, 8-16 ohms, 22in x 14in x 8in.
**$43.75 ea.**
Hi power system with MSP 12UAX and 2MBC tweeter. 23½in x 17in x 12½in. 20 watts **$53.75 ea.**

FAMOUS MULLARD MAGNAVOX **Bookshelf enclosures**
6WR MKV and 3UC tweeter, 8-16 ohms, 15½in x 8¼in x 8½in.
Complete ready for use.
**$26.75 ea.**
Cabinet only **$13.95**

***All cabinets are constructed of Pineboard and veneered with oiled teak Formica and are complete with cross over network — tweeter — innerbond packing.***

# AMATEUR BAND NEWS AND NOTES

by Pierce Healy, VK2APQ

## ITU Disaster Relief Plan

A recent publication from the International Telecommunication Union describes a proposal for a system to restore telecommunications after natural disasters and similar emergencies, using satellite long distance links in conjunction with an air transportable communications center.

A recent press information booklet issued by the International Telecommunication Union describes a disaster relief system using satellite long distance links in conjunction with an air transportable communication centre.

While the proposal does not encompass a specifically amateur service activity, it does mention amateur frequency allocations and on that score should be of interest to amateur radio operators. On the other hand it could also provide an opportunity for the amateur service to provide a service to community in general.

At its World Administrative Radio Conference in 1959, the ITU adopted a recommendation on the use of radiotelegraph and radiotelephone links by Red Cross organisations which requested:

a. That administrations take account of the possible need by the Red Cross for rapid communication by radio when normal communication facilities are disrupted;
b. That administrations study the possibility of assigning for this purpose, at the upper or lower limits of the amateur bands, one or more common frequencies to stations of the Red Cross.
c. That the next Administrative Radio Conference should consider whether any further action is necessary.

It appears that the request made in 1959 has helped the work of the Red Cross. However, propagation phenomena as far as short-wave communication is concerned has prevented round the clock operation. Satellites do not have this disadvantage and thus offer reliability of service.

At its World Administrative Radio Conference for Space Telecommunications held in Geneva from 7th June to 17th July, 1971, the ITU adopted another recommendation on the use of space radiocommunication systems in the event of natural disasters, epidemics, famines and similar emergencies. The recommendation requests:

1. That administrations, individually or in collaboration, provide for the needs of eventual relief operations in planning their space radio communication systems and identify for this purpose preferred radio frequency channels and facilities which could quickly be made available for relief operations;
2. That administrations concerned waive the co-ordination procedures provided for in the Radio Regulations in the case of transportable earth stations used for relief purposes.

It is known that the industrialised countries have resources to provide for bringing relief to parts of the country hit by natural disaster. This is not the case however, in the new and developing countries, where catastrophes such as typhoons can repeatedly hit several areas in one season.

On a United Nations map, reproduced in the booklet are shown the sites of the gravest natural disasters which occurred between 1961 and 1970 for which an appeal was made to the League of Red Cross Societies. These appeals which totalled approximately 110 were caused by cyclone, flood, earthquake, volcanic eruption, fire, drought, famine and epidemics. The sites represent large population centres situated near the equator particularly between longitudes 0° and 95° West (a line running through Southern Mexico, centre of United States and Canada) and 0° and 130° East (a line running across Australia, West Aust. border, and between Japan and Korea).

The proposal is for two geostationary satellites placed in orbit over the equator, above the Atlantic and Indian Oceans. These would cover the areas between the longitudes mentioned and allow direct communication between transportable earth stations and a Disaster Assistance Office located in Geneva. Not only do the United Nations, the Red Cross, World Health, World Medical and International Labour Organisations and ITU have their headquarters there, but Geneva is situated near the longitudinal mid-point between the extremes of the natural disaster prone areas.

The ITU is taking steps to implement the Recommendations of the World Administrative Radio Conference for Space Telecommunications. The Union has submitted to the United Nations Development Program a request for finance to continue its studies through technical consultations, production of prototype equipment, field testing and the ultimate production of several mobile telecommunication equipment packages.

As was indicated, this is not an Amateur Service project as such. However, the Amateur Service is the largest and most flexible single radio communication service in the world. It is an official international service both in earth based and space communication fields. It has untold resources in both technical know-how and equipment.

Amateur radio operators, as individuals or groups, have provided and will no doubt continue to provide, emergency radio communication services to the community when required.

With these facts in mind several questions could be asked which may warrant close consideration and action if the image and place of the amateur service in the community is to be expanded.

Could the official amateur radio societies within ITU member countries, through the International Amateur Radio Union co-operate with the ITU and Red Cross in this project on an official basis?

Can the amateur service provide some degree of permanent facility for long term assistance?

Can amateur radio societies of the Region III Association do more to influence government administrations in developing countries to encourage and assist the growth of amateur radio activity in their areas?

Could future amateur satellites be designed to provide a backup communication system for such emergency traffic?

What amateur frequency allocations if any, are suggested for satellite communication circuits?

If amateur frequencies are to be used either for ground based or space circuits, why not an IARU international amateur service organisation to augument the ITU and Red Cross facilities in time of emergencies?

These are just a few questions that have come to mind, and there are probably many others that could be suggested. It is true that many amateur radio operators are apathetic towards such activities as envisaged by the questions, but it is also true that others only require a lead and official authority to carry out a service for mankind and his community. Unfortunately the first of these facts is very often successfully used to deride the overall potential of the amateur service.

On the other hand, officialdom very often restricts and discourages initiative on the part of indivicuals and amateur radio organisations.

The apathy on the part of some amateurs and the attitude of some in official positions have probably been a contributing factor for the lack of acceptance of the amateur service at its full value in a community. Surely now is the time to explore possible areas into which the full potential of the amateur service can be absorbed.

Maybe on an international basis, organised through the International Amateur Radio Union by the national amateur radio societies, there may be found a part for the amateur service to play in projects such as the ITU Disaster Relief Plan.

It is up to amateurs individually and collectively to see that their national society is not apathetic towards exploring such possibilities.

### ITU CELEBRATION

All the 141 countries members of the International Telecommunications Union are actively preparing to celebrate the Fourth World Telecommunication Day.

This day has been fixed for 17th May, 1972, the anniversary of the establishment of the Union in Paris in 1865, 107 years ago, which makes the ITU the oldest of the intergovernmental organisations in the United Nations system.

The theme for the Fourth World Day is "The World Telecommunication Network".

A poster has been designed, as well as some postage stamp designs, to enable Post, Telephone and Telegraph Administrations of countries who are members of the ITU to prepare special issues.

On the occasion of the first world telecommunication exhibition organised in Geneva from 17th to 27th June, 1971, the International Telecommunication Union arranged a world-wide competition "Youth in the Electronic Age". Details of this competition were given in the July 1971 issue of these notes.

Information received by the organisers indicates that many countries will be sending, on a national level, entries to be judged by the international jury in Geneva.

The winners will be selected in Geneva on 17th May, 1972, as part of the Fourth World Telecommunication Day. Several countries have indicated that they intend to organise special events in honour of the winners.

A number of member countries, telecommunication organisations and travel agencies are providing valuable prizes: air tickets with accommodation arrangements, various types of radio equipment, scholarships, books, etc.

### 29 DX CLUB

The annual general meeting of the 29 DX Club in Western Australia held in January 1972 elected George Allen as an Honorary Life Member of the 29 DX Club. This was in recognition of his outstanding work associated with international 1.8MHz DX experiments. Club officers for 1972 are:

| | |
|---|---|
| Chairman | Cec Whalley VK6KK |
| Secretary | Alan J. Gibbs VK6PG |
| Treasurer | Peter Dew VK6EU |
| Newsletter Editor | Sean Ryan VK6JR |
| NFD Manager | Cliff Waterman VK6NK |
| VHF Liaison Officer | Leigh Harrison VK6WA |
| WIA & RSGB Liaison | Alan J. Gibbs VK6PG |

Club station VK6II QSL manager Alan J. Gibbs

The club takes its name from Zone 29 which includes VK6, VK8 and VK9 call areas of Christmas Island and Cocos Island. Details of the clubs activities may be obtained from the secretary, Alan J. Gibbs, VK6PG, 12 Munyard Way, Morley, WA 6062.

From the February issue of the 29 DX Club "Radio Newsletter" the following information on amateur radio station Golf-Four-Radio-Susan was gleaned.

G4RS is the headquarters station of the Royal Signals Amateur Radio Society, located at Blandford, Dorset, England. Operating on CW, AM, SSB and RTTY, it transmits on all bands at various set times.

G4RS will make a QSO, and QSL any amateur radio station it contacts, but it will not draw you into the net, if running, unless you are a member of the society.

The Royal Signals Amateur Radio Society is the second best known amateur radio society in England. Its members hold or have held, call signs of nearly every country in the world.

It has a central secretariat at Blandford to maintain an up-to-date record of membership and activities. The "Mercury", journal of the RSARS is published quarterly.

Membership—

Ordinary membership

Shall be granted to any serving, or retired member

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, NSW 2200.

*Pictured during a recent visit to Australia is Loren Windom W8G2, seated, after whom the Windom antenna is named. With him are members of the QCWA (from left to right): VK2VN, VK2YP; VK2APQ; VK2ADE; VK2JX; VK2DA; VK2AND; VK2WD; VK2AYT; VK2ASM; VK2AKO. (See story below.)*

of the Royal Signals, including Royal Signals T & AVR.

— Associate Membership

1. Any serving, or retired, member of the British Army.

2. Any serving, or retired, member of the Australian Signal Corps, or Commonwealth Signal Corps.

Subscriptions:

For ordinary and associate membership $1.10 per year, or $11.12 for life membership.

For further information and application forms, contact Sean Ryan, VK6JR, 23 Ballarat Street, Morley, West. Aust. 6062. Sean's Royal Signal number is 575.

## QCWA

The Sydney Chapter of the Quarter Century Wireless Association held its February meeting at the Combined Services Club, Barrack Street, Sydney on Wednesday 9th, 1972. The guest for the evening was Howard Lilley. VK2AYT, Video Products Manager, Ampex Australia Pty Ltd. Howard, a well known Sydney amateur, has travelled extensively throughout the USA, Canada and the Pacific area in the course of his business commitments.

As is normally the case the gathering took the form of dinner followed by an informal discussion, and members were entertained by Howard describing the latest video recording equipment produced by his company and answering many questions.

Howard also described the amateur radio equipment he used and the hospitality extended to him by the American amateurs he had met and visited during his overseas trips.

### Distinguished visitor

Harry Caldecott, VK2DA, president of the Sydney Chapter, QCWA, his wife, daughter and son-in-law Mr and Mrs S. C. Underhill were recently hosts to QCWA members and their wives at an evening given in honour of their special guest Loren G. Windom, W8GZ and his wife, who were on an eighteen day tour of Australia and Tasmania. At the conclusion of the tour they left to return via South Africa, to their home in Reynoldsburg, Ohio, USA.

W8GZ, known as "Windy" to many DX operators is probably better known by amateurs all over the world through the "Windom Antenna" which bears his name. Naturally, discussion during the evening centred around the design of this popular antenna.

Some interesting facts that emerged from the discussion were that, while "Windy" admits to starting the project, and finishing it by writing the article for publication in amateur radio magazines, he says that most of the work was done by two collegues working on the project with him. Further, the title "Windom Antenna" was bestowed on it by members of the Wireless Institute of Australia, who received a copy of his article for publication in "Amateur Radio".

Apart from amateur radio W9GZ has had a distinguished career as a General in the USA Armed Forces, in the legal profession as a Judge in Columbus, Ohio, and the commercial field.

Members of the QCWA present at the evening were most appreciative of the opportunity to meet "Windy", W8GZ and his wife. Before leaving Sydney the visitors also spent two days with Frank Leverrier, VK2ADE and his wife.

## WIA ACTIVITIES

In January 1972, a major change became effective in the administrative structure of the Wireless Institute of Australia. Although each division was a corporate body registered as a company in its own State, the Federal body was not. Following acceptance of a new Federal Constitution by the Divisions, The Wireless Institute of Australia has been incorporated as a Company limited by guarantee. The Company has six members, these being the six Divisions.

The Divisions will still be represented by a Federal Councillor, and the annual general meeting becomes the Federal Convention at which the Federal Councillor, holding written authority, votes on behalf of his Division. The vote of the Federal Councillors binds the Divisions on the decisions made. There will be no ratification of the minutes of the Convention by members of each Division as in the past.

The incorporation also allows the transfer of the institute magazine "Amateur Radio" to the Federal body. The magazine was published in the past by the Victorian Division.

There is no concept of a Headquarters Division in the new Articles and the Federal Executive is appointed by Federal Council at each Federal Convention.

Including the President and Editor of "Amateur Radio" there are six members of the Federal Executive. In addition the Articles provide for a secretary appointed by the Executive. The secretary has no vote and will in fact be a paid employee.

It has been stated that many of the changes that have been made in the Federal structure are designed to facilitate the handling of day to day affairs of the institute.

## NEW SOUTH WALES

At the general meeting of the New South Wales Division held at 14 Atchison Street, Crows Nest, on Friday night, 25th February, 1972, members heard an excellent lecture on Antenna Matching.

The lecturer was Jim Rowe, VK2ZLO, Editor of "Electronics Australia" who gave a very enlightening discourse on the part a feedline plays in the transfer of power from the transmitter to the antenna, and what happens when a mismatch occurs between the feedline and antenna.

Jim also explained how misleading readings could be taken by the insertion of an SWR meter at the transmitter end of the feedline. The construction and use of several pieces of equipment for assessing the efficiency of an antenna system were also discussed.

It appeared evident from the interest shown and the questions asked, that several fallacies and not fully understood facts had been resolved for those present.

### Central Coast Field Day

The attendance at the 1972 Central Coast Field Day, held at the Gosford Showground, on Sunday, 20th February, was an all time record. Amateur operators from Sydney, Newcastle, the Blue Mountains and the North Coast and tablelands, many with their families took the total registrations to 452. Perfect weather prevailed during the day, which allowed full enjoyment of the field events by the participants and pleasant conditions for those who indulged in the inevitable "rag-chew" among old acquaintances.

The members of the Central Coast Amateur Radio

Club are to be congratulated on the organisation of the event, particularly the ladies and helpers who served morning and afternoon teas and a hot lunch for those attending. Communication systems at the grounds included 10 watt base stations operating on 52.525MHz FM; Channel B 146.0MHz FM; 7.0MHz SSB; via the Channel 1 Repeater and a 10 line automatic telephone exchange connecting various points of activities around the grounds. The latter unit was constructed by Ross Mudie, VK2ZRQ.

In addition to the field events there were displays of some of the latest commercial type amateur equipment, amateur television, sale of disposal equipment, a demonstration of cottage weaving, lucky dips, quizzes, bus tour of the district and visit to the Reptile Park.

The members of the club express their appreciation to the business houses and individuals who donated prizes for the various events.

## WIA YOUTH RADIO SCHEME NEW SOUTH WALES

As a New South Wales Division project the WIA operates a Youth Radio Club at 14 Atchison Street, Crows Nest. The club operates on approximately every other Saturday afternoon from 1.30 pm to 4.30 pm. Lecture room and practical workshop facilities are available as well as the facilities of the communication room.

These facilities are available to young people attending high school in the Sydney area, providing that there is no radio club at the school they attend. Because the membership of the club for full time training is already at maximum capacity, new members can only be offered training assistance in the practical field on a one day per month basis.

However new members will also be welcome to attend other club activities such as field days and visits to places of technical interest. The dates for practical training are set out as follows; 22nd April, 20th May and 24th June. The attendance time is from 1.30 pm to 4.30 pm. The activity schedule for the second half of 1972 will be issued later. On registering members will be notified in good time of extra club activities.

For any information regarding this club's activity ring the club supervisor, Dave Jeanes, telephone 969 2312 or the secretary, Wireless Institute Centre, during business hours at 43 5795.

Young people who attend the one day per month practical training are required to enrol under the YRCS Correspondence Section so that they study their theory by correspondence while obtaining their practical tuition.

The address to enrol in the correspondence section is: Supervisor, YRCS Correspondence Section, 34 Flower Street, Fern Tree Gully, Victoria 3156.

### Westlakes Radio Club

The Westlakes Radio Club has been granted special approval to conduct AOCP classes as an annexe of the Hamilton Evening College with the full approval of the New South Wales Department of Education.

The Education Department has advised that classes will be conducted at the club on two nights per week with subject listings as follows:

Monday — Electrical and radio theory and electrical calculations. (2 hours).

Wednesday — Applied electronic theory, radio regulations and Morse telegraphy. (2 hours).

Full details are available from the club or from the Hamilton Evening College (telephone the Principal Mr K. Kelly, 61 3950 after 7.00 pm only).

This course is open to both members and non-members.

### Maitland Radio Club

Mr O. J. Story, manager of radio station 2HD, has announced that a shield known as the "2HD Radio Shield" will be given to the club and contested for by members with their home built projects displayed at the Maitland Show each year. The shield will be kept in the club rooms and the winner's name will be engraved on it.

The president of the Club Kevin Watson, VK2BLW on behalf of the committee and members has expressed warm appreciation to the management of 2HD for their action in encouraging the young people who are interested in radio and electronics.

Kevin has also expressed on behalf of MRC members their appreciation to the management of "Electronics Australia" magazine, who have donated a 12-month subscription to the magazine as another of the prizes.

The display of equipment at the MRC stand at this year's Maitland Show should be a particularly spectacular one, with members spurred on by the prospect of winning such prizes as the 2HD Radio Shield and the "E-A" subscription.

### QUEENSLAND

The first annual general meeting of the Redcliffe Radio Club was held on Monday, 7th February, 1972. In his report the president, John Aarsse, VK4QA, referred to some of the highlights of the club's activities during the first year of its existence. Among the points mentioned were that the classes for the various YRCS certificates were well attended. Although the AOCP classes started well only 25% finished the entire course.

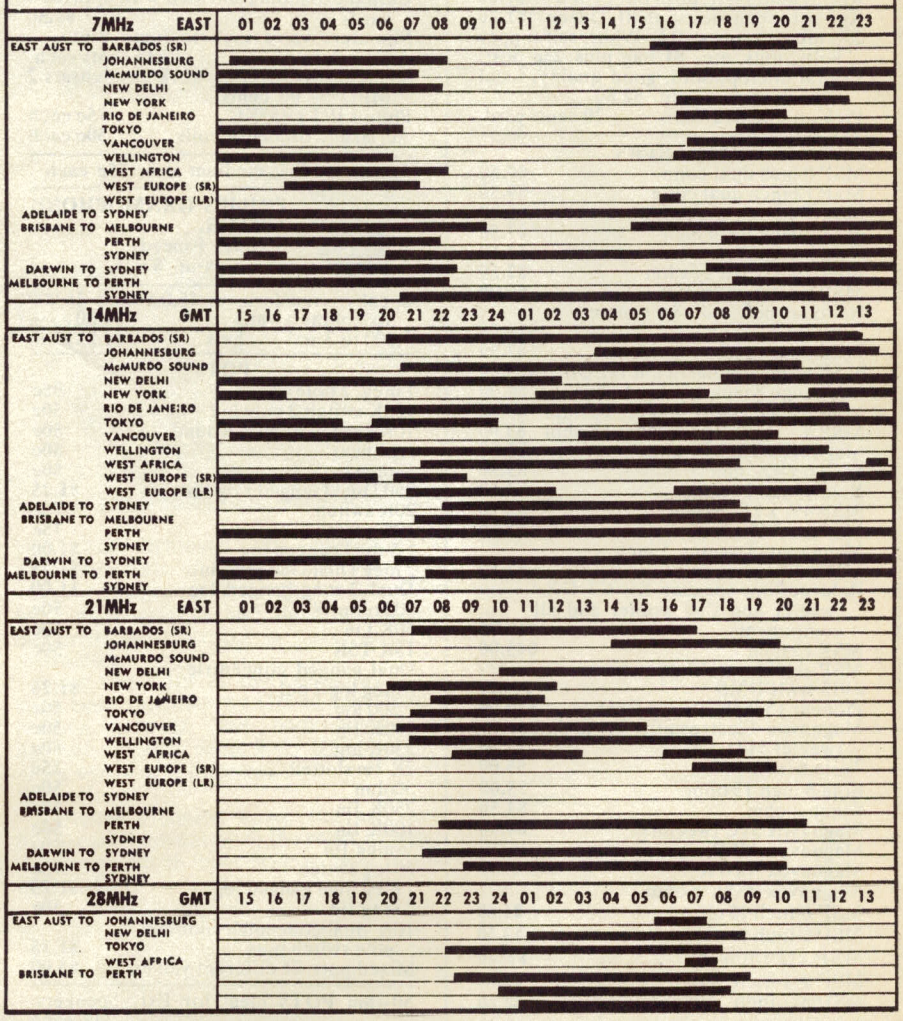
The club station VK4RC operated from the 1971 Redcliffe Agricultural, Industrial and Horticultural Society Show. A static display of QSL cards was featured and over 150 contacts were logged on three bands. The club also participated in the WIA convention with an exhibition of old radio valves and television camera tubes.

Consideration has been given to the Redcliffe Award and others are proposed for 1973 / 1974.

Appreciation was expressed for the assistance the late Stan Armstrong, VK4SA has given the club also, to members and others who had assisted during the year.

## IONOSPHERIC PREDICTIONS FOR APRIL

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). They have been prepared for the four most popular amateur bands over a number of interstate and international circuits. Black bands indicate periods when circuit is open. 4.72




### VICTORIA

### Geelong Amateur Radio-TV Club

The GARC study group is progressing through the syllabus for the AOCP examination in September. Also, the overall progress of the construction of the club's amateur television transmitter is going well and is moving towards on-air tests.

Members of the Geelong Amateur Radio-TV Club are busy planning details for their 1972 "Hamfest" to be held on the first weekend in May. Efforts are being made to make it more successful that the one held in 1971. Intending visitors to the Hamfest may obtain further details from the secretary, Bob Wookey, VK31C., GARC, P.O. Box 520, Geelong, Vic 3220.

# TUDOR RADIO

L. E. CHAPMAN ESTABLISHED 1940

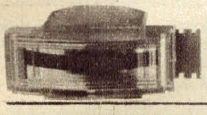
**103 ENMORE ROAD, ENMORE, NSW 2042.**

**PHONE 51 1011** NEW POSTAGE RATES PLEASE ADD EXTRA

Knobs long shaft, push on. Dozen **$1.20**
Knobs for concentric shaft. Dozen **$1.20**
250 mixed screws. BA, Whit., self-tapper bolts, nuts, etc. **$1** bag plus **25c** post.
Crystal microphones, good quality, ideal tape recorders, etc. **$2.80.**
Pick up shielded Wire **20 cents** yard.

**SPEAKERS**

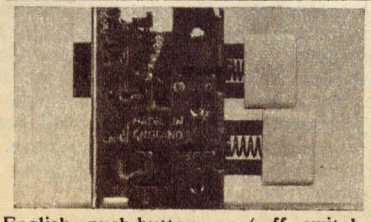
| | |
|---|---|
| MSP 8-inch dual-cone | $7.50 |
| MSP 12-inch dual-cone | $9.50 |
| MSP 7 x 5 | $5.00 |
| MSP dual-cone 6-inch | $7.50 |
| Rola 6 x 4 | $3.50 |
| Rola 5 x 3, 15 or 27-ohm | $2.50 |
| MSP 6 x 9, 8 or 15-ohm | $6.00 |
| National hi-fi built in tweeter 8-ohm | $14.00 |
| Peak dual-cone | $7.50 |
| MSP 12-inch radial beam 12PQB | $25.00 |
| Mid range 8 inch woofer 4-ohm | $6.00 |
| MSP 5 / inch large magnet 15-ohm | $3.00 |
| MSP 4 / inch large magnet 15-ohm | $3.00 |
| Magnavox 6 x 9. 27-ohm | $5.00 |
| MSP 6 x 4,8-ohm | $3.50 |
| Rola 4-inch 27-ohm | $3.00 |
| MSP 4¼ x 2¾ 8-ohm | $2.50 |
| MSP 6 x 5 15-ohm | $2.00 |
| Magnavox Tweeter 5-inch HF5SIC | $7.50 |
| Rola custom speaker Kit C3 GX tweeter and C60 woofer and all components | $19.05 |
| MSP 15-inch | $45.00 |
| MSP dual-cone 12 aux 2015-watt RMS | $17.50 |
| Pioneer 15-inch 30-watt RMS | $40.00 |
| Magnavox Electrostatic 3½-inch tweeter Md1 3.5 | $2.50 |
| Tesla 8-inch 4-ohm | $5.00 |
| Rola 8-inch 15-ohm | $5.00 |
| 8-inch 3-ohm | $4.50 |
| Magnavox 3TC tweeters | $4.00 |
| Magnavox 8WR | |
| Magnavox 12WR | |
| Magnavox 8-30, 8-ohm | |
| MSP 6-inch 15 ohm | $4.00 |
| MSP 5-inch tweeters | $3.50 |
| MSP 2¼-inch | $2.50 |
| MSP 2½-inch | $2.50 |
| MSP 2¾-inch | $2.50 |



**RECORD LEVEL INDICATOR METERS $1.50**

**SMALL 2 GANG TUNING CONDENSERS**

Complete with direct drive scale **$1.75**

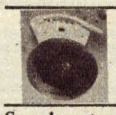


English push-button on / off switches, **75c** each. Pack and post **10c.**

**MIXED RESISTORS,** 3.5 and 10W I.R.C., **25 for $2.**

Curled expanding shielded wire approx. 7 yards **$1.50**
Miniature valve sockets 7 and 9 pin **15 cents** each.
Speaker Crossover network Condensers 2 MFD — **60 cents.**
Philips IFT's 455KC **75c** each
Aerial and oscillator coils **50c** each

Transistor IFs, medium size, **75c** each



**PHILIPS GRAMOPHONE MOTOR.**
6 volts, 4-speed. and pick-up **$7.75.**

Speaker transformers 15,000 and 25,000 to 3 ohms 6 watts **$1.50** each
5,000 to 3 and 15 ohms **$1.25** each

**POTS**

| | |
|---|---|
| 1 meg. 2 pole switch | 95c |
| 100K switch 2 pole log | 50c |
| 10K carbon or wire wound | 50c |
| 1.5 linear | 50c |
| ½meg log | 50c |
| 250 Dual Ganged Log Pots | $1.25 |
| 20K switch | 75c |
| 10K switch | 75c |
| 1.5 dual ganged log | $1.00 |
| 2 meg Dual Ganged Lin. | $1.25 |
| Dual 3 meg ganged log | $1.00 |
| 500 ohm WW | 50c |
| 50K Lin | 50c |
| 15K T5K | 50c |
| Dual ganged concentric 2 meg log 2 pol | $1.25 |
| 7,500 log | 50c |
| 200K 1in | 50c |
| 250K log | 50c |
| 2K 1in slotted | 25c |
| 50ohm | 50c |
| 250K 1in | 50c |
| 100K 1in | 50c |
| ½meg 1in | 50c |
| 50 log switch | 75c |
| 1 meg dual ganged log | $1.25 |
| 2 meg 1in | 50c |
| 10K dual-concentric double-pole switch pots | $1.25 |
| Mixed pots, 25 different values | $5.00 |

**50-ohm POTS** ideal for Ext. Speakers. **50c** each

**BELLWIRE** 2c yard

**DIODES:**

| | |
|---|---|
| OA79 | 40c |
| OA81 | 40c |
| HR15 | 50c |
| OA605 | 50c |
| IN295 | 50c |
| AD4002 | 50c |
| OA630 | 50c |
| EM484 silicon | 75c |
| IN3492 | $1.00 |

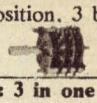
Transistor ear plugs 3 for **$1.00**
Tag strips, mixed types Dozen, **60c**
Switches, Oak 4-position **50c** each
2-position **40c** each

**3½ AMP. FUSES $3.50** 100.

**Din Plugs, 3 or 5 pin 50c each.**

**Push button switch,** 4 position and 1 postoggle switch, **$1.**

**Switch,** 4 position, 3 bank, **75c.**



**ELECTROS: 3 in one**

| | | |
|---|---|---|
| 50uF | 250VW | 415VP |
| 8uF | 350VW | 415VP |
| 10uF | 350VW | 415VP |

**75 cents each.**

**Electros CHASSIS MOUNT.** 100uF 350 WK 400 peak **75 cents**

**BSR** 4-speed Gramophone Motor and Pickup, Stereo **$19.00**

**POWER TRANSFORMERS**
150 volts per side 6.3 30 Mil **$2.50.**

**METAL RECTIFIER,** 150 watt, ¼ amp, **$1 each.**

TV aerial lead in **10c** yard
Tuning Condensers, 2-gang or 3-gang — **$1** each.

**Portable** record player cabinets, shop soiled. **$2.50** each

2 amp fuses **$3.50** per 100
Transistor plastic outer case, **50c** each
Stereo pick-up arms, with Xtal, **$6.00** ea.
Metal rectifiers for battery and electirc portables **50c** each, post **10c**
Pilot lamp holders **60c** per doz.
100 Mixed Knobs including TV channel changers **$10.00**
3¼ amp fuses **$3.50** per 100
10 for **50c**

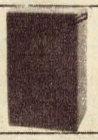
**SPECIAL 25 ONLY**
Stereogram, 6-valve, well known make, 5 watts RMS per channel **$27.50.**

**AMPLIFIERS SOLID STATE**
8 watts R.M.S. per Channel **$54.00**

**Tape recorders portable** MR 115 AC, DC Sanyo **$65.**

Morganite and IRC resistors. At least 33 values. Suit transistors, radios, TV etc., **$2.00** per 100. Pack and post. **25c.**
100 mixed condensers, micas, ceramics, tubular. Fresh stock. **$2.00.** Pack and post **25c.**
50 + 24, 350vw + 100uF 25vw, **75c** each
30 + 30 300VW 250VP **75c** each
Many others. Invaluable for service.

2meg. Lin Pots **50c**
**RCA 7 INCH TAPE SPOOLS 50 cents**



**SPEAKER CABINET,** size 19 x 15 x 9. Suite 12-inch and 3-inch tweeter. **$12.50**

**PILOT LIGHTS,** Plug in **10 cents**

**SWITCH WAFERS**
**20 cents** each.

| | |
|---|---|
| Vibrators, 6 volt sync | $3.50 |
| 4-volt sync | $2.50 |
| 24-volt sync | $2.50 |
| 32-volt non sync. | $3.50 |
| Electros 500uF 10VW Vp12. | 40c |

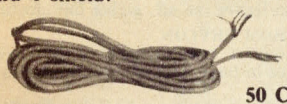
**GENERAL TV CABINET,** 9 inch, **$12**

**Stereo Head Phones,** good quality, **$7.75**

**Neon** 240 volt bezel lights, **75 cents each**

**SPEAKER ENCLOSURE** size 19 x 15 x 9 inches. Complete with two 8 x 4 speakers and 3-inch tweeter, including cross-over network, in 8 or 15-ohm **$25**

**5½ yards MULTI-STRAND CABLE** 5 and 1 shield.

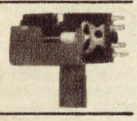


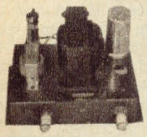
**50 CENTS**

**MINI CABLE 4 STRAND ONE SHIELDED,** lots of uses including microphones, etc. **10c** yard

**CABLE, 9 STRAND,** including 1 shield and OCTAL PLUG LENGTH, 6 yards, **$2**

**B.S.R. CERAMIC CARTRIDGE STEREO $5**

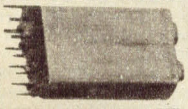




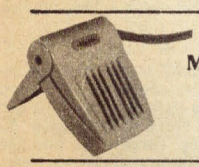
**AMPLIFIERS,** 3½ watts, size 7½ x 5 x 4½ **$10**

**9-INCH PICTURE TUBES.** General 9UPE **$20**

**TV IF COILS, IDEAL FOR COIL FORMERS $1 dozen**



**SPEAKER CABINETS 10 x 7 x 4 $3.50**



**MICROPHONES ACOS CRYSTAL $2.80.**

**90 PER CENT COMPLETE**

$5 the pair

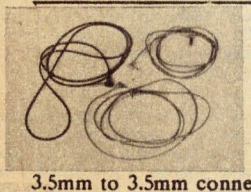
**TRANSISTOR AMPLIFIER AND TUNER**

AMP size 3½ x 1½ x 1¼ tuner 3¼ x 1¾ x ½ (circuit supplied) **$5.00**
Sharp 12 inch TV cabinets **$17.50**
Sharp TV Pictubes 12 inch **$29.50**
Sharp Yokes Fly Back Transformers. Pots, Diodes, Transistors, Speakers, Tuners, etc.

Transistor miniature speaker transformers **50c** each
Transistor speaker transformers 3.85 to 3.50 C.T. **1.00**
Portable TV car Cradle **$4.00**
Portable TV Aerials **4.50**

**TRANSISTOR EAR PLUGS** complete with plug lead and pouch **95 cents**

**STEREO GRAMOPHONE,** motor and pick-up, 4 speed **$12.50**



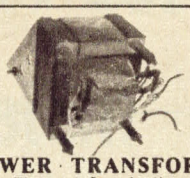
6.5mm jack plug & 7ft shielded cable **95c**

6.5mm to 3.5mm plug adaptor & 7ft shielded cable 95c

3.5mm to 3.5mm connector, 7ft shielded cable **95c**

Jack plug sockets, 6.5mm **35c**

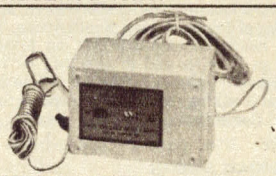
**DIAL DRUMS,** 5 inch, 3½, 3 ⅜ **50c ea.**



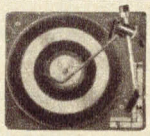
**TV POWER TRANSFORMER, $8** 300 mil. Two 6.3 windings, 200 volt secondary for Bridge Type Rectifier.

**50 M CHOKE $1.** Pack and Post 30 cents, Interstate 60 cents. **300M Choke $2.50.**

**M.S.P. MODEL 2MBC TWEETER SPEAKER. RANGE 5KHZ TO 20KHZ. NEW RELEASE $5.00.**



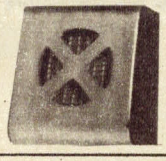
**BATTERY SAVER,** 6 or 9 volt DC 300MA, **$11.00**



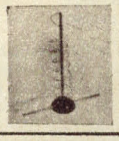
**B.S.R. RECORD CHANGERS**

C117—A—1 supersedes MA70 **$42**
C117—A—3 supersedes MA75 **$52**
UR15 UA15 **$27.50**

**TRANSISTOR EXTENSION CABINETS**
Complete with 5-inch speaker and lead.
**$3.50**



**INDOOR TV AERIALS $1 50. Pack and Post 25c**



**Electros** 20 400-450
**Electros** 10 400-450 **75c each**
**Electros** 15 50-65

**100 MIL power Transformer $6**

**POTS**

1 meg. Dual Ganged Log **1.25**
1 meg. Dual Ganged Lin **1.25**
½ meg. Switch Pot double pole log **75c**

**RADIO KNOBS** push on mixed, 12 for 50c

**HEAT SINKS,** size 4 x 2 **$1.00 each**

**TRANSISTORS**

| | | | |
|---|---|---|---|
| 2N1110 | 40c | AT492 | 50c |
| 347OE | 40c | AT430 | 50c |
| TN297A | 40c | AT324 | 50c |
| AT337 | 40c | AT473 | 50c |
| AT322 | 40c | AT20 | 50c |
| AT420 | 40c | AC188 | 75c |
| AT323 | 40c | AT350 | 90c |
| AT347 | 40c | AD149 | $1.50 |
| AT410 | 50c | AC187 | $1.75 |

**6 VOLT PILOT LIGHT,** screw in **ea. 15c.**

**RESIN CORE SOLDER 5 yards 75c**

**SHARP FLYBACK TRANSFORMERS,** 8ft 604 **$7 each**

**SHARP TUNERS** for 12 inch, **$19 each**

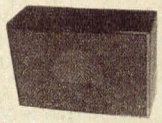
**SHARP TRANSFORMER 9T7171, $2**

**SHARP DEFLECTION COIL** DC179, **$18**

**SHARP SPEAKERS, 8 ohm 1107P 244 $4**

**LOT OF OTHER PARTS FOR SHARP INCLUDING DIODES, POTS, KNOBS, TRANSFORMERS, COILS, ETC.**

**STEREO SPEAKER LEAD, 10 cents yd.**

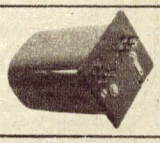


**Speaker Cabinet** 10 x 7 x 4 with 5 inch speaker **$5.50**

**GARRARD PLUG IN STEREO CARTRIDGE, $6.00**

**TESLA 4 SPEED**
Gramophone motor and pick-up 4-pole motor, balanced arm **$25.**

**SPECIAL**
25 different values. Mixed pots for **$5**



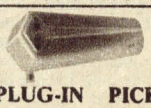
**600 ohm to 600 multi tap line output transformers $1**

MSP 12Aux, 20-watt RMS 45-12000Hz **$17.50**

**TV legs,** set of 4 **$1.** Size 5¼ inch. **$1.00**
**10K Double pole concentric pots $1.25**
**Electros 8MFD VW VP 300 350 4 for $1**

Speaker Plugs, 4 pin **15 cents**
Speaker Sockets **15 cents**

**ELECTROS 20 MFD 200 P.V. 20c**



**PHILIPS PLUG-IN PICK-UP CARTRIDGE,** mono **$3.50**

**TEST PRODS 50 cents pair**

**STEREO JACK PLUGS 75 cents**
**Mono 50 cents**
**3:5 mil 25 cents**

**CASSETTES** C 60 top brand **$1.20**

**RECORD CHANGER:** DUAL 12-10. Shielded motor **$58.00**

**POWER TRANSFORMERS:**
100-milliamp **$4.50**
300mA, 225V per side **$8.00**
50mA, 220V per side **$4.00**
Transistor type, 240V to 40V centre tapped, 6.3V
Transistor type, 240V to 150-CT-150, 6.3V 1A.

# LISTENING AROUND THE WORLD

by Arthur Cushen, MBE

## *Fiji to continue on short-wave*

Reports in overseas magazines have stated that Radio Fiji is closing its short-wave services, but this is not likely at present, according to the Chief Engineer of the Fiji Broadcasting Commission.

There have been frequent reports from overseas that the Fiji Broadcasting Commission is to close its short-wave service due to the expansion of its medium-wave services. Radio Fiji is heard widely in the South Pacific in the 90 metre band with the Hindi-Fiji program on 3286KHz, and English on 3230KHz, up to 1100GMT.

We asked the Chief Engineer of the Fiji Broadcasting Commission to comment on these reports of closure and Mr P. L. Littin replied "The Commission has made no statement about terminating these transmissions. I may have mentioned in correspondence that with the recent installation of three more medium-wave transmitters, tropical short-wave coverage of the group is no longer necessary, nor will local listeners use it. However, until the Commission is completely satisfied that the medium-wave coverage is satisfactory the short-wave will be left in service."

Though no changes in facilities are imminent, the FBC is to make substantial changes to its programs, which carry three languages on two networks. Radio Fiji 1 broadcasts in Fijian and English, and Radio Fiji 2 in Hindustani and English. The transmission schedule will remain 1800 to 1045GMT daily, with sign-off on Saturday at 1100GMT.

### BANGLADESH VERIFIES

A verification letter has come to hand from Radio Bangladesh at Dacca in which they expressed appreciation for our reception report on 15520KHz when they were heard with English news at 1230GMT. A recording of their sign on announcement was featured in the "DX World" program on Radio New Zealand.

In the letter, Mr M. Muhaddes commented that "We were simply delighted to receive your letter. We are happy to know that you are taking the trouble to record our opening announcement and then broadcast it in the internal service of Radio New Zealand. Thank you for doing so. Your country has recognised Bangladesh a few days back, and we are very pleased. Mr Cushen, you can listen to our Overseas broadcast every day at 0230GMT on 9850KHz and 1230GMT on 15520KHz".

The address given was Government of the People's Republic of Bangladesh, Radio Bangladesh, Dacca, Bangladesh.

### TASHKENT USING 6040KHz

Radio Tashkent in Uzbekistan, USSR, which for many years has used 9600KHz and 11925KHz, began operating on 15115KHz some months ago, and last month they made an appearance on 6040KHz as well. These four frequencies are used for English news at 1200, and 1400GMT. Excellent reception at 1400GMT is possible on 6040KHz, but 15155 is rather poor, as this channel is subject to interference. The English transmissions are 30 minutes long and are beamed to India. The station welcomes reception reports, addressed to Radio Tashkent, 49 Khorezm Street, Tashkent, Uzbekistan, USSR.

### CHANGES FROM STOCKHOLM

Radio Sweden, Stockholm, recently made some frequency changes in order to improve reception in various parts of the world. It appears likely that some channels could be subjected to interference.

| GMT | KHz new | KHz old |
|---|---|---|
| 1230-1300 | 15105 | 9670 |
| 2015-2115 | 9715 | 9745 |
| 0445-0615 | 17840 | 17865 |
| 0515-0615 | 9715 | 9745 |
| 1830-1930 | 11705 | 11780 |
| 0300-0430 | 11705 | 9745 |

### SWAZILAND TESTING

A new transmitter of Radio Swaziland has commenced test transmissions on short-wave, according to Colin Miller of Johannesburg, South Africa. The station has been heard on 0600-1600GMT on 6155KHz, 0400-0600GMT on 3223KHz and to 2000GMT on 1600KHz. A medium-wave frequency, 1376KHz, is also being used. The station is asking for reception reports to be sent to Swaziland Commercial Radio, PO Box 941, Mbabane, Swaziland.

### TOKYO USING 6030KHz

In its present schedule, Radio Japan has introduced a new frequency, 6030KHz, for a service to the Asian mainland.

Several other frequency adjustments have also been made. The present schedule of the Regional services, which include the new frequencies, is as follows:

| GMT | KHz |
|---|---|
| 1130-1215 | 6030, 6080, 7140 |
| 0900-1100 | 15105, 11780, 9530 |
| 1230-1330 | 11875, 11705, 9675 |
| 1745-1915 | 11965, 9670. |

The frequencies for the other regional services remain unchanged.

These include the Australian and New Zealand service 0930-1030GMT on 11875 and 15235KHz.

### MADAGASCAR OPERATIONAL

Radio Nederland relay station in Madagascar is increasing its schedules as it becomes fully operational, and is now broadcasting as follows:

| GMT | KHz | Language |
|---|---|---|
| 0800-0920 | 17790 | Indonesian |
| 0930-1050 | 17810 | Dutch |
| 1100-1220 | 15195 | English |
| 1700-1820 | 6020 | Dutch |
| 1830-1950 | 6020 | English |
| 2130-2250 | 7290 | English |
| 2300-0020 | 7105 | Indonesian |
| 0030-0150 | 7105 | English |

### KARACHI ON 15325KHz

Radio Pakistan at Karachi has been observed on the new frequency of 15325KHz at 1830GMT and with a program in Arabic. This frequency provides excellent reception. At 1840GMT, a news bulletin in Arabic is carried, and, the station closes at 1845GMT with a full announcement in Arabic and the Radio Pakistan theme.

### TESTS FROM PRAGUE

Czechoslovakian Radio at Prague has been using 11780KHz at 0700GMT in its hour-long English transmission to Australia and New Zealand. This frequency is also used by Radio New Zealand and so considerable interference resulted to both transmissions.

Following our suggestion to Radio Prague, three new frequencies were tested in the 25-metre band, in order to find a better channel. They are now using 11900, 11910 and 11990KHz, as suggested by their Monitoring Section. The three frequencies suffered from interference to some degree, but it is expected that one of them will now be in regular service, replacing 11780KHz for the period 0700-0800GMT.

### WIBS ON 11930KHz

The Windward Island Broadcasting Service has been heard on a new frequency of 11930KHz to sign off at 2130GMT, by Bryan Clark, of Wellington, NZ. The station is actually announcing as Radio Grenada, and is best received after 2102 when Kuwait leaves the adjacent frequency of 11925KHz. Radio Grenada has commercials and request music up to 2130GMT, then the station leaves the air, giving full identification.

### TESTS FROM CEYLON

Radio Ceylon has been heard on several new frequencies in the course of establishing its external service.

Recently the tests were observed on 21445KHz with a program beamed to Europe. In recent weeks a new frequency of 11735KHz has been heard broadcasting the external service from 1030 to 1130GMT. We have also observed the same program on 15120KHz. English news is broadcast at 1045 and then a comment and music. From 1115 the program is in Asian languages. The station requests reception reports on this test transmission, sent to the Director of Engineering, Radio Ceylon, Torrington Square, Colombo-7 Ceylon.

### RECENT VERIFICATIONS

SINGAPORE: Following the closing of the British Forces Broadcasting Station in Singapore, the 10KW transmitter has been taken over by Radio Singapore and broadcasts on 5010KHz on a test basis. The station has confirmed our reception of this frequency. Verification was received airmail and included a card and personal letter, which was signed by Taufig Ahmed, for the Director of Broadcasting, Singapore. The address is PO Box 1902, Singapore 11.

MADAGASCAR: The test transmissions from Radio Nederland at Madagascar on 15260KHz were verified from Hilversum with a card specially designed to commemorate the opening of this new relay station. The card has a map of Madagascar showing the location of the new relay transmitter, and drawing of some of the country's principal geographical features. Reports should be sent to PO Box 222, Hilversum, Holland.

VATICAN: Michael Chapwin, Smithton, Tasmania, has heard Vatican Radio on 21485KHz beamed to Australia and New Zealand. The broadcast was heard weekdays at 1125GMT and the station verified by airmail in 13 days.

KUWAIT: Radio Kuwait has verified Michael Chapwin, with a card following reception on 15345KHz from 0400-0500GMT. The verification, received in six weeks, shows the national flag and dress, and contains information about the country and stations. They operate four 250KW transmitters.

### ROME ON 21695KHz

Italian Radio has introduced a new service for reception in Australia of a program in Italian, broadcast 0830-0915GMT. We first observed this service on 9630KHz, and Bryan Clark of Wellington, NZ reports that it is also being carried on the new frequency of 21695KHz. Both these channels give very good reception in New Zealand. This transmission is at a more suitable time for listening in Australia than the former service broadcast at 0600GMT.

## BROADCAST BAND NEWS

HAWAII: KIVM (now the new call for the former KTOH on 1350KHz) has been heard with news in English at 1600GMT. KHAI has been heard on its new frequency of 1080KHz, changed from 1090KHz. KHAI has sports news at 1630GMT. Another new Hawaiian is KISA, operating on 1540KHz which has been heard at 1700GMT.

PAPUA-NEW GUINEA: The annual report of the Australian Broadcasting Control Board for the year ended 30/6/71 says that during the period under review a motion of the Papua-New Guinea House of Assembly called for the Administration and the Australian Government to establish a Papua-New Guinea Broadcasting Commission, to take over and extend the broadcasting services of the territory and that the matter is the subject of study by the officers of the department.

## FLASHES FROM EVERYWHERE

### EUROPE

MONACO: The "DX Special" of Trans World Radio in English is now broadcast on Saturdays at 0930GMT on 9640KHz, at 1745GMT on 9575KHz, and from Bonaire on Thursdays at 0045GMT on 11815KHz. Trans World Radio now also broadcasts in Turkish Monday to Friday at 1815GMT on 11705KHz.

### AFRICA

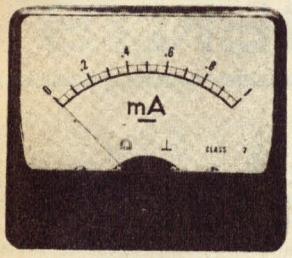
SAHARA: Radio Sahara, Apartado, 7, El Aaium, has extended its schedule and now operates from 0655 to 2400GMT. Their short-wave frequency, 7230KHz, has been heard in this area at sign-on. The frequency is also used by the BBC at this time and this is the main cause of interference to Radio Sahara. According to reports from the United States the station is now verifying.

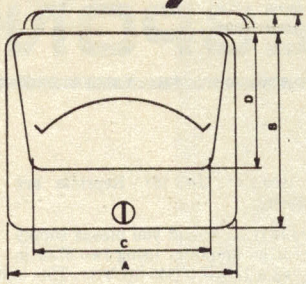
Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, New Zealand. All times are GMT. Add 8 hours for WAST, 10 hours for EAST, and 12 hours for NZ.

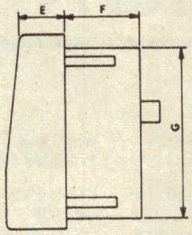
# University

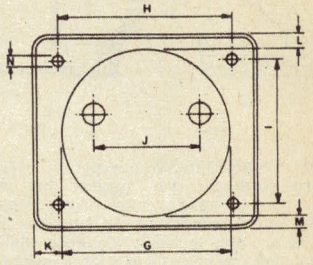
# IMPORTED PANEL METERS

## V.P. SERIES




Available in three models — VP2A — VP3A — VP4A

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VP2A | 75 | 65 | 62 | 44 | 10 | 25 | 56 | 48 | 48 | 30 | 10 | 6 | 3 | 3 |
| VP3A | 55 | 51 | 43 | 30 | 7 | 24 | 46 | 42 | 38 | 25 | 4.5 | 2 | 2 | 3 |
| VP4A | 46 | 43 | 38 | 25 | 10 | 22 | 38 | 33 | 33 | 21 | 4 | 2.5 | 3 | 2 |

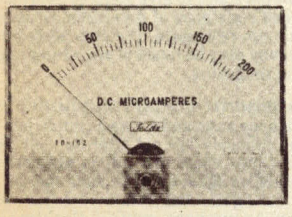
Ranges normally available from stock.

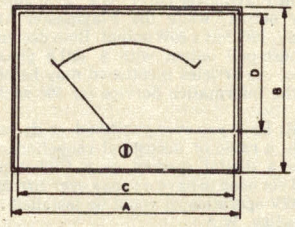
**VP2A**
0-50uA DC
0-100uA DC
0-500uA DC
0-1mA DC
0-1mA DC (0-30V. Scale)
0-5mA DC
0-10A DC
0-50mV DC
V.U.

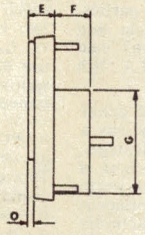
**VP3A**
0-50uA DC
0-100uA DC
0-500uA DC
0-1mA DC

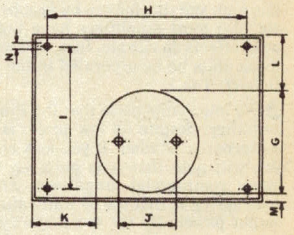
**VP4A**
0-50uA DC
0-100uA DC
0-1mA DC

## T.D. SERIES




Available in four models — T.D. 152 — T.D. 118 — T.D. 86 — T.D. 66.

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TD152 | 152 | 110 | 145 | 78.5 | 17 | 24 | 69 | 133 | 95.5 | 38 | 41 | 36 | 4 | 3 | 4 |
| TD118 | 118 | 106 | 112 | 67 | 14.5 | 24 | 69 | 101.5 | 90.5 | 38 | 24 | 24 | 12 | 3 | 2 |
| TD86 | 86 | 78 | 80 | 46 | 13 | 24 | 69 | 57 | 57 | 38 | 8 | 4 | 4 | 3 | 2 |
| TD66 | 66 | 60 | 62 | 34 | 13 | 24 | 55 | 48 | 48 | 24 | 5 | 3 | 3 | 3 | 2 |

Ranges normally available from stock. 0-50 uA — 0-200 uA — 0-1mA D.C. available in all four models. These models can be rear mounted using the panel cut-out "C" and "D".

### RECOMMENDED TRADE PRICES IMPORTED PANEL METERS

Prices are subject to change without notice. Orders accepted subject to prices ruling at time of delivery. Every effort is made to deliver orders promptly, and where possible prior notice will be given re price changes. Prices are Plus Sales Tax.

* Denotes meters normally carried in stock. Quantity discounts on application.

| | VP2A | VP3A | VP4A | TD66 | TD86 | TD118 | TD152 |
|---|---|---|---|---|---|---|---|
| | $ c | $ c | $ c | $ c | $ c | $ c | $ c |
| 0-50 uA | * 6.60 | * 6.00 | * 5.50 | * 6.40 | * 6.60 | *7.50 | * 11.00 |
| 0-100 uA | * 6.00 | * 5.40 | * 4.90 | 5.80 | 6.00 | 6.90 | 10.50 |
| 0-200 uA | 6.00 | 5.40 | 4.90 | * 5.80 | * 6.00 | * 6.90 | * 10.50 |
| 0-500 uA | * 5.50 | * 4.90 | 4.40 | 5.30 | 5.50 | 6.40 | 10.00 |
| 0-1 mA | * 5.40 | * 4.80 | * 4.30 | * 5.20 | * 5.40 | *6.20 | * 9.80 |
| 0-5 mA | * 5.60 | 5.00 | 4.60 | 5.40 | 5.60 | 6.40 | 10.00 |
| 0-10A | * 5.60 | 5.00 | 4.60 | 5.40 | 5.60 | 6.40 | 10.00 |
| 0-50 mV | * 5.60 | 5.00 | 4.60 | 5.40 | 5.60 | 6.40 | 10.00 |
| V.U. | * 6.40 | 5.80 | 5.30 | 6.20 | 6.40 | 7.30 | 10.80 |

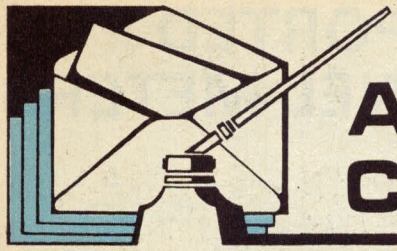

## University Graham Instruments Pty. Ltd.

106 Belmore Road, Riverwood, NSW, 2210.
Telephone: 53 0644 (5 lines).
Telegrams and Cables: Raquip, Sydney.
City Office: Instrol Electronics Centre, 91A York Street, Sydney — 29 4258.
Victorian Office: 180 York Street, Sth. Melbourne. Phone: 699 1126.


### REPRESENTATIVES

**WA: Sandovers Ltd.**
**28 Belmont Ave, Belmont, PERTH, 6104. Ph: 65 0111**
**TAS: W. P. Martin and Co. 202 Argyle Street, HOBART, Tas, 7000**
**And 32 Canning Street, LAUNCESTON, TAS, 7250, 22 844.**
**SA: Compar Distributors P/L. 35 Market Street, ADELAIDE, SA, 5000 51 6264**
**NEWCASTLE DISTRICT Hunter Engineering Sales P/L 64 Broadmeadow Rd, Broadmeadow, NEWCASTLE, NSW, 2303. Phone: 61 4321.**
**PORT KEMBLA DISTRICT, Hundelj Engineering Sales P/L. 8-11 Kembla Court, Wentworth St, PORT KEMBLA, 2505 43 397**
**Qld: Gee & Co, 35 Railway Terrace; Milton, Bris. Qld 4064. Phone: 36 0344.**

Also available from all leading wholesalers.



# ANSWERS TO CORRESPONDENTS

**COMPONENTS IN NZ:** In your July, 1971 "Answers to Correspondents", you suggest that New Zealand readers knowing of agents for components may like to pass on the information. In Auckland, Turnbull and Jones are able to supply Motorola, Philips and RCA semiconductors as well as a large range of capacitors, resistors and other parts for the constructor. The staff are helpful, and the shop is open on Friday nights. (R.L., Auckland, NZ.)

Thank you for the information, R.L., which should be of assistance to some of our readers.

**GUITAR AMPLIFIER:** About a month ago I received from you the reprint of the Playmaster 125 guitar amplifier. Since then I have written to several well known manufacturers. Your amplifier is advertised at approx $110 constructed — which is by far the cheapest 50 watt amp. available. Does this mean that the quality of reproduction is sacrificed to keep the cost down? Is this amp suitable for use by groups at dances, parties, etc? Do most amplifiers have built in tremolo, and what effects do vibrato, fuzz, and wah wah have?Could these units be incorporated in the PM125? (R.A., Nth Hobart, Tas.)

We must emphasise that the Playmaster 125 guitar amplifier, despite its low price, is not in any way a compromise. Rather, if you look at the specifications, you will note that it is quite up to the standard of many commercial amplifiers. Another point worth considering is that the 50 watt rating is for continuous output power. By far the majority of manufacturers quote power output in the misleading terms of "peak power" or "peak music power". These terms enable manufacturers to give very high power ratings for their amplifiers. On your other questions, we know of quite a few groups who use "Playmaster" guitar amplifiers and speakers — primarily for economy, but also because they give a good performance. Many amplifers do not have an inbuilt tremolo facility, but the PM125 does have this. Vibrato, fuzz and wah wah are all "gimmicks" which some performers use to "liven up" their music. There is no reason why they could not be incorporated in the Playmaster 125 if desired. For more information on these effects, and circuits to build them, see the following articles: Guitar preamp with vibrato, November 1968 (File no 1/GA/14); Fuzz box, August 1967, (1/GA/10); and Wah Wah, May 1969, (1/GA/16). Reprints are available for 50c each.

**PUSH-PULL AMPLIFIER:** Would you please supply me with a circuit for an amplifier using two 6L6s in push-pull output using a 12AX7 phase inverter. This is for use as a 50-60W bass guitar amplifier. Could you also tell me the values of components needed to take KT88s in push-pull for later modification of the circuit. (D.P., Langwarrin, Vic.)

We have not described an amplifier which meets your requirements exactly. The nearest design is a high quality 35W PA amplifier (File No 1/PA/20) described in December, 1961. This uses EL34s in a push-pull output with a 12AX7 phase splitter. An earlier design for a 100W PA amplifier (1 PA 19), of July, 1960, uses KT88s in push-pull output with two 6CG7s as drivers and phase splitters. We have described two guitar amplifiers (not bass) which may meet your requirements. The Playmaster 116 (1/GA/8) of June, 1967 has a 40W output, while the Playmaster 117 (1/GA/9) of July, 1967 has a 60W output. Both designs use 6DQ6s in push-pull output with a 6BL8 phase splitter. Copies of the articles mentioned may be obtained through the Information Service for 50c each.

**RANGEFINDER:** Have you ever published, or do you intend to publish, a radio or acoustical rangefinder? This could have a digital readout or a CRT type display. It would not need to have a range over 100yds. If designed for 12V operation, it could be installed in a car. (J.L., Daglish, W.A.)

We have never described such a device and, quite frankly, yours is the only request we have ever received. It would be difficult to design such a device without some more detailed knowledge of its operational requirements.

**TERMS, ETC.** I receive your magazine every month, and think it is very good. Could you please explain the following terms: balun, toroid, CW, DSC, PN, RST, VDR. Is it allowable for an Australian amateur to operate on the 2400MHz (12½cm) band? Would a transmitter (incapable of transmitting intelligence) built solely for testing aerials need to be licensed? Could you tell me what type of valves the following are: 6V6GT, 5V4-5, 6A8G, 6G8G? To what does the resistance of a variable resistor refer — maximum or minimum resistance? Could you please tell me the address of Rola? (M.D., East Mackay, Qld.)

Balun is an abbreviation for BALanced to UNbalanced transformer, used in aerial inputs to connect a balanced feedline to an unbalanced input. A toroid is a ring-shaped ferrite former used for winding special inductors. CW is an abbreviation for Continuous Wave DSC refers to the Double Silk Covering on a wire. PN is a semiconductor junction between P-type and N-type material. RST means readability, strength, tone — a system of describing the quality of radio reception. A VDR is a voltage dependent resistor. Australian amateurs have the use of the 2300-2450MHz band on a "secondary service basis". In regard to a transmitter to test aerials, we suggest you get in touch with the Radio Branch, PMG's Department. For information on the valves you mentioned, it would be best to consult a manufacturer's data book — unfortunately we cannot afford the space to give you this information here. The marked resistance of a variable resistor refers to its maximum resistance. The address of the Plessey Rola Company may be found in any of their advertisements in the magazine.

**HEADPHONE AMPLIFIER PROBLEM:** I built your headphone amp, and it was a simple job. However, one of the channels cuts out after the unit has been on for some time. When the unit is switched off and then switched on again both channels operate, and then one cuts out again. Also, I have not been able to get 9V across the two links, only 7V. Can you suggest what is wrong? (K.W., Lawley, WA.)

We assume the headphone amplifier you have built is the Playmaster 130 stereo headphone amplifier of January, 1971. (Readers should note that the full description of the project they are referring to should be quoted in correspondence.) The kind of fault you are experiencing could arise from purely mechanical trouble, such as faulty wiring (dry joints), plug and socket not making a perfect connection, or even a fault in the headphone wiring, and these should firstly be thoroughly checked. If you are satisfied that the fault is not from one of these causes, then it may be an electronic fault, such as thermal instability. In view of your remarks concerning your limited experience we doubt whether you would be successful in locating and fixing

## "ELECTRONICS AUSTRALIA" INFORMATION SERVICES

As a service to readers "Electronics Australia" is able to offer: (1) Project reprints, metal work dyelines, photographs, printed wiring patterns and other filed material to do with constructional projects and (2) A strictly limited degree of assistance by mail or through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: These cost 50c per project. Prior to December 1959, circuits and diagrams only are available. From December 1959 onwards, complete articles are available. No material can be supplied, additional to that already published. Reprints can be supplied more speedily if they are positively identified and not accompanied by technical queries. Material not on file can normally be supplied in photostat form at 30c per page.

SUBSCRIPTIONS, BINDERS, HANDBOOKS etc: These are handled by seperate departments. For fastest service, send separate orders to the departments concerned.

PHOTOGRAPHS, METAL WORK DRAWINGS: Original photographs are available for most projects. Price: $1 for 6in x 8in glossy print. Metal work dyelines are available for most projects. Price: $1 These show dimensions and positions of holes and cut-outs, but give no wiring details.

PRINTED WIRING PATTERNS: We can supply negative transparencies, actual size. Price: 50c. We do NOT deal in manufactured boards. These are available from advertisers.

BACK NUMBERS: As available. On issues up to six months, face value. Seven months to 12 months, face value plus 5c. Thirteen months or older, face value plus 10c. Postage and packing, 10c per issue extra. Please indicate if a PROJECT REPRINT may be substituted if the complete issue is not available.

REPLIES BY POST: These are provided to assist readers encountering problems in the construction of our projects published within the last two years. Note, particularly, that we cannot provide lengthy answers, or undertake special research or modifications to basic designs. Charge: 50c. Inclusion of an additional fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee and may be answered in the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

COMMERCIAL EQUIPMENT: "Electronics Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals equipment etc. We are therefore not in a position to comment on any aspect of such equipment.

COMPONENTS: "Electronics Australia" does not deal in electronic components. Prices, specifications etc should be sought from appropriate advertisers or agents.

REMITTANCES: These must be negotiable in Australia. Where the exact charge may be in doubt, we recommend submitting an open cheque, endorsed with a suitable limitation.

POSTAGE & PACKING: All charges shown include postage and packing, unless otherwise specified.

ADDRESS: All requests for data and information should be directed to the Assistant Editor, "Electronics Australia", Box 2728, GPO Sydney, NSW, 2001. — (10/71)

such a fault, and you may have to hand the job over to someone with a little more experience. Concerning the low voltage on the supply rail, you mention only the voltage across the links. Have you checked to see whether you are obtaining 18V or close to it from the power supply. Measure the voltage from the positive end of filter capacitor to chassis and, if voltage is low at this point, it may be that the capacitor is at fault.

**MEASURING OUTPUT VOLTAGE:** I am 14 years old, and enjoy reading your magazine very much. I have recently been experimenting with the variable power supply described in the "Reader Built It" section, in the December, 1969 issue. However, I can get the voltage down only to 100V, using 6CM5 valves. I tried using resistors at the output, but when the voltage was measured with a multimeter none of the ranges agreed with the others. I even tried it with a B battery and a 3.3-megohom resistor in series with it, and achieved the same result. Can you tell me why this occurs, and how to measure the voltage correctly? (G.G., Gunnedah, NSW.)

Normally, we are not in a position to comment on "Reader Built It" projects, G.G. Our staff has not had the opportunity to build and test the projects in question, so we publish the names and addresses of the contributors to the section (now called "Circuit and Design Ideas") so that, if difficulties arise, readers can contact the contributors direct. However, your particular query is not specifically related to the equipment, but is rather a matter of faulty procedure. The point you have failed to appreciate is that, if a resistor is used to reduce the voltage, the actual voltage available will depend on TWO factors; the value of the resistor AND the current which will flow through it into the load. Thus the voltage will change for every change of load. In your case the voltmeter is the load — admittedly a small one — and the load changes with every change of range. Thus, on the highest range, the load will be lightest and the voltage developed across the dropping resistor will be small. As lower ranges are selected, the load increases and so does the voltage across the dropping resistor. The only way to determine the correct value of a dropping resistor, using your voltmeter, is to connect the intended load across the whole setup, and measure the voltage across the load. Even then some allowance must be made for the load presented by the meter although, in most cases, this will be small enough to be ignored. Your basic problem of voltage range arises from the wrong bias conditions for your 6CM5 valves. The article stated that it may be necessary to vary bias resistors according to the type of valves used. The best values of resistors can be determined only by trial and error. First try changing the value of the 27K shunt resistor, or eliminating it altogether; if this does not give sufficient range, experiment with a lower value in place of the 250K series resistor.

**SUBSTITUTION OF VALVES:** I would like to substitute 6BM8 valves for 6GW8s in the stereo amp and PA system described in the Nov 1966 issue, as I have a large supply of 6BM8s on hand. I realise that an alteration to socket connections would be required. What other changes to components would be required to effect the substitution? Would it affect the power output of the amplifier? (R.P., Elwood, Vic).

The substitution of 6BM8 valves for 6GW8s in such equipment is not recommended, R.P., as the triode and pentode sections of the two types are completely different. Although 6BM8s have been used in such service, and are capable of delivering the same power, bias arrangements and gain will be different, necessitating extra gain in earlier stages of the amplifier.

**CIRCUIT REQUIRED:** I recently acquired an old five-valve radio receiver, but I have no circuit or data. If any of your readers have the circuit diagram for a Healing "Golden Voice" radio, I should be grateful if they would contact me. (Bruce Pierson, 35 The Expressway, Albion Park, NSW 2527.)

At your request, we have published your name and address, and hope that readers will be able to assist you with your problem.

**CUSTOMS DUTY:** In addition to "Electronics Australia" I receive regularly a magazine of English origin. In many of the projects, components needed are not available locally. I want to order these parts direct from the UK firms named. If I do so, will customs duty be payable, and if so, how much? (R.S., Goorambat East, Vic.)

Duty would almost certainly be payable on most, if not all, items purchased from the UK. Information as to the rates of duty payable should be sought from the Department of Customs and Excise.

**DISPOSALS CRT:** I have a 3in cathode ray tube, type 3AP1, and I should like to build an oscilloscope using this tube. Have you published a design using this tube, or one which could be adapted to it? (P.F., Crawley, WA.)

We described an oscilloscope using this ex-disposals tube in the January, 1948 issue. A project reprint of the original article can be obtained through the Information Service for the normal 50c fee (File No 7/C/4).

## NOTES AND ERRATA

CODE OSCILLATOR. (Five One-Transistor Projects, January 1972, 3/MS/32). There are two errors on the wiring board layout on page 72. The end of the 22K resistor shown connected to the 0.039uF capacitor should be connected to the other end of the 0.039. The output lead on the third strip from the left should be moved to the fourth strip, so that it comes from the 0.1uF. The circuit diagram is correct.

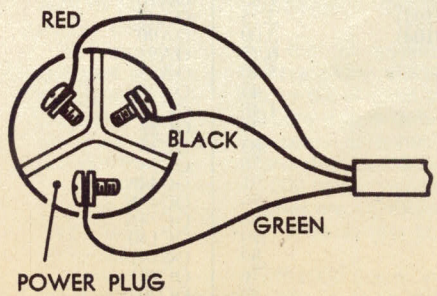
LOW COST STEREO SYSTEM: (January 1972, File No 1/SA/38) The code numbers for the printed wiring pattern given in the text and parts list are incorrect. The correct number, to be used for ordering, is 72/sa1.

PLAYMASTER 125 GUITAR AMPLIFIER: (July 1969, File No 1/GA/17) pp83,95. The EM401 diodes shunting the 18 ohm lower leg of the bias network are shown wired in reverse polarity. Wired as shown they will have little adverse effect on the amplifier's performance, but they cannot function in their intended role of temperature compensators.

HIGH VOLTAGE POWER SUPPLY (September 1971, File No. 2/PS/27): On page 55, there is an error in the wiring board that causes the metering components to be shorted out when the meter is switched to current monitoring. The link from the meter shunting components should be extended to the copper strip carrying the junction of the 22 ohm and 1 ohm resistors.

AUTODIM: (July 1971, File No 2/PC/14). On page 59, the fuse in the slave circuit diagram should be moved to the A1 side of the Triac. This avoids damage to the 1K gate resistor when the fuse blows.

LOW COST STEREO SYSTEM: (January 1972, File No 1/SA/38). Several readers have commented on the diagram on page 39, querying the connection of the active and neutral leads to the three pin plug. Contrary to what some readers apparently believe, there is strictly no regulation requiring that the active, neutral, or earthing conductors be connected to a plug or socket in any specific order. All that exists is a recommendation that the pins be wired in the order earth, active, neutral, in a clockwise direction, when viewed from the front of the socket. In practice, this convention will have been followed in the vast majority of installations. Since the wiring we showed does not conform to it, the black and red leads should be transposed, as shown.



POWER PLUG
(LOOKING AT SCREWS)

PLAYMASTER 129: (October 1970, File No 1/SA/33). Several readers have reported problems with "motorboating" when the treble control is fully advanced. This can be cured by connecting 56K limiting resistors in series with the "boost" side of the treble potentiometers.

ALL PRICES INCLUDE TAX AND POSTAGE

# IMPORTED COMPONENTS

## P.O. BOX 1683P, MELBOURNE 3001

| | |
|---|---|
| 1N645 | .84 |
| 1N914 | .51 |
| IN3491 + R | 1.75 |
| IN3492 + R | 1.83 |
| 1N3493 + R | 2.36 |
| 1N3660 + R | 1.99 |
| 2N174 | 6.09 |
| 2N217 | 1.24 |
| 2N277 | 2.32 |
| 2N301 | 2.66 |
| 2N301A | 3.84 |
| 2N384 | 2.88 |
| 2N406 | 1.01 |
| 2N417 | 1.77 |
| 2N441 | 1.80 |
| 2N443 | 3.22 |
| 2N456A | 4.20 |
| 2N489B | 14.76 |
| 2N591 | 2.20 |
| 2N649 | 2.12 |
| 2N696 | 1.13 |
| 2N697 | 1.17 |
| 2N706A | 1.80 |
| 2N930 | 1.80 |
| 2N1038 | 3.92 |
| 2N1046 | 17.94 |
| 2N1073B | 7.59 |
| 2N1302 | 1.01 |
| 2N1303 | 1.01 |
| 2N1305 | 1.13 |
| 2N1306 | 1.32 |
| 2N1307 | 1.32 |
| 2N1308 | 1.64 |
| 2N1309 | 1.64 |
| 2N1546 | 5.85 |
| 2N1639 | 1.20 |
| 2N1908 | 27.74 |
| 2N2102 | 2.78 |
| 2N2147 | 3.60 |
| 2N2148 | 3.60 |
| 2N2160 | 2.40 |
| 2N2188 | 2.79 |
| 2N2270 | 2.40 |
| 2N2646 | 2.19 |
| 2N2647 | 3.15 |
| 2N2669 | 6.53 |
| 2N2926 | 2.25 |
| 2N3005 | 5.32 |
| 2N3054 | 1.80 |
| 2N3525 | 3.70 |
| 2N3563 | .90 |
| 2N3564 | 1.08 |
| 2N3565 | .86 |
| 2N3566 | 1.01 |
| 2N3567 | 1.08 |
| 2N3691 | .86 |
| 2N3692 | .90 |
| 2N3694 | .90 |
| 2N3702 | 1.01 |
| 2N3703 | .96 |
| 2N3704 | 1.77 |
| 2N3705 | 1.73 |
| 2N3706 | 1.65 |
| 2N3707 | 1.14 |
| 2N3708 | .80 |
| 2N3716 | 5.30 |
| 2N3731 | 3.17 |
| 2N3790 | 11.25 |
| 2N3819 | 1.77 |
| 2N3826 | 1.68 |
| 2N4121 | 1.04 |
| 2N4250 | 1.17 |
| 2N4354 | 1.28 |
| 2N4355 | 1.65 |
| 2N4356 | 1.65 |
| 2N4360 | 1.58 |
| 2SB186 | 1.50 |
| 2SB407 | 3.30 |
| 2SB474 | 3.30 |
| 2SD150 | 1.50 |
| 2SF28 | 5.60 |
| 3N140 | 2.55 |
| 3N141 | 2.34 |
| AA119 | .36 |
| AB1101 | 1.20 |
| AB1102 | .87 |
| AC107 | 2.28 |
| AC125 | .96 |
| AC126 | .96 |
| AC187 / 188 | 2.36 |
| AC128 | 1.05 |
| AC132 | 1.01 |
| AC172 | 1.20 |
| AC187188 | 2.36 |
| AD149 | 2.45 |
| AD161 / 162 | 4.32 |
| AN1102 | .68 |
| AN1103 | .60 |
| AN1104 | .60 |
| AN1105 | .60 |
| AN2001 | .45 |
| AN7102 | .90 |
| AN7105 | .68 |
| AS147 | .80 |
| AS148 | .76 |
| AS208 | 1.46 |
| AS301 | .81 |
| AS306 | .84 |
| AS307 | .84 |
| AS308 | .84 |
| AS310 | .99 |
| AS311 | .96 |
| AS312 | .93 |
| AS313 | .92 |
| ASY73 | 2.12 |
| ASY76 | 2.10 |
| ASY77 | 1.68 |
| AS216 | 3.03 |
| AS217 | 2.59 |
| AS218 | 2.91 |
| AS220 | .98 |
| AS221 | 2.16 |
| AT316 | .68 |
| AT318 | .68 |
| AT319 | .69 |
| AT321 | .69 |
| AT322 | .63 |
| AT323 | .68 |
| AT324 | .68 |
| AT325 | .83 |
| AT331 | .92 |
| AT337 | .69 |
| AT338 | .70 |
| AT341 | .70 |
| AT350 | 1.14 |
| AT1138 | 2.66 |
| AX1101 | 1.53 |
| AX1103 | 1.70 |
| AX1104 | 1.86 |
| AX1108 | 1.86 |
| AX1127 | 1.50 |
| AX1130 | 1.50 |
| AX1131 | 1.77 |
| AX1132 | 1.50 |
| AX1142 | 1.20 |
| AX1143 | 1.58 |
| AX1144 | 1.44 |
| AX1166 | 1.37 |
| AX6168 | 1.98 |
| AY1102 | 1.04 |
| AY1108 | 1.65 |
| AY1113 | .69 |
| AY1119 | .60 |
| AY6108 | 1.65 |
| AY6109 | 1.65 |
| AY8108(8103) | 3.75 |
| AY8109(8104) | 3.00 |
| AY8112 | 6.75 |
| AY8135 | 5.40 |
| BA100 | .44 |
| BA102 | 1.46 |
| BA114 | .39 |
| BC107 | .83 |
| BC108 | .76 |
| BC109 | .91 |
| BC147 | .76 |
| BC148 | .68 |
| BC149 | .79 |
| BC157 | .89 |
| BC158 | .76 |
| BC159 | .89 |
| BC177 | .91 |
| BC178 | .84 |
| BC179 | .92 |
| BC186 | .79 |
| BC207 | .72 |
| BC208 | .63 |
| BC209 | .75 |
| BC212 | $2.00 |
| BCY10 | 2.59 |
| BCY11 | 3.24 |
| BCY12 | 3.14 |
| BCY39 | 5.19 |
| BCY71 | 2.05 |
| BCZ210 | 1.95 |
| BCZ211 | 2.37 |
| BCZ212 | 2.16 |
| BD139 | 3.67 |
| BD140 | 3.90 |
| BDY20 | 2.63 |
| BDY38+ | 2.62 |
| BF115 | .87 |
| BF145 | .64 |
| BF173 | 1.14 |
| BF177 | 1.63 |
| BF178 | 1.80 |
| BF179 | 2.04 |
| BF184 | .72 |
| BF185 | .72 |
| BF194 | .67 |
| BF200 | 1.32 |
| BFY51 | 5.19 |
| BSX19 | 2.16 |
| BSX20 | 2.39 |
| BT100A / 500R | 3.00 |
| BT101 / 500 | 5.40 |
| BTY79 / 100R | 2.70 |
| BTY79 / 300R | 3.45 |
| BTY79 / 500R | 5.19 |
| BY127 / 800 | 78 |
| BYX21L / 200R | 1.35 |
| BYX38 / 300 + R | 1.32 |
| BYX38 / 600 + R | 1.62 |
| BYX38 / 900 + R | 2.08 |
| BYX38 / 1200 + R | 3.03 |
| BYX39 / 600 + R | 3.14 |
| BYX39 / 800 + R | 3.88 |
| BYX39 / 1000 + R | 4.53 |
| B2X70Scvies | 1.95 |
| B2Y88C303toC11 | .83 |
| B2Y88C12toC30 | .98 |
| BZY95 Scvies | 2.16 |
| BZY96 Scvies | 2.16 |
| BZZ15to29 | 2.37 |
| C20D+ | 6.60 |
| C106 / Y1 | 2.10 |
| C122D | 3.78 |
| D13TI | 1.95 |
| DTG110B | 6.96 |
| DTG1010 | 15.16 |
| EM402 | .45 |
| EM408 | .80 |
| EM410 | 1.40 |
| FLV100 | 3.30 |
| FPT100 | 1.80 |
| H35 | 8.07 |
| MB1 | 2.03 |
| MB3 | 2.65 |
| MB6 | 3.40 |
| MB8 | 4.30 |
| MJE2955 | 4.55 |
| MJE3055 | 3.06 |
| MPF104(Fet) | 1.10 |
| OA5 | 0.65 |
| OA10 | 0.87 |
| OA47 | 0.65 |
| OA90 | 0.32 |
| OA91 | 0.33 |
| OA95 | 0.39 |
| OA202 | 0.75 |
| OC20 | 6.38 |
| OC22 | 3.03 |
| OC23 | 3.80 |
| OC24 | 3.45 |
| OC44N | 1.11 |
| OC45N | 1.11 |
| OC74N | 0.96 |
| OC140 | 1.95 |
| OC141 | 2.60 |
| OC201 | 3.80 |
| OC202 | 3.70 |
| OCP70 | 2.60 |
| OCP71 | 4.32 |
| ORP12 | 0.95 |
| ORP60 | 1.75 |
| PA40 | 4.83 |
| PB40 | 7.26 |
| SC45D | 11.10 |
| SC50D | 13.00 |
| SC146D | 3.70 |
| SE2001 | 0.98 |
| SE2002 | 1.20 |
| SE3001 | 1.12 |
| SE5001 | 2.10 |
| SE5002 | 2.10 |
| SE5003 | 2.48 |
| SE5020 | 4.05 |
| SE5023 | 3.15 |
| SE5025 | 1.35 |
| ST2 | 1.50 |
| T1 / 40 / A2 | 3.30 |
| T13027 | 2.61 |
| TIC44 | 1.68 |
| TIC45 | 1.88 |
| TIC46 | 2.05 |
| TIC47 | 2.30 |
| TIP31A | 2.10 |
| TIP32A | 2.70 |
| TIP33A | 2.98 |
| TIS34 | 2.46 |
| TIS43 | 2.36 |
| ZD Series | 1.98 |
| 40360 | 2.48 |
| 40361 | 2.70 |
| 40407 | 2.52 |
| 40408 | 2.98 |
| 40409 | 3.15 |
| 40410 | 3.30 |
| 40411 | 9.70 |
| 40669 | 3.50 |
| FETS | |
| 2N4889 | 2.70 |
| 2N5245 | 2.62 |
| 2N5459 | 1.77 |
| 2N5485 | 1.77 |
| MPF102 | 1.00 |
| I.C.'S | |
| FUL709 | 1.75 |
| FUL723 | 3.95 |
| FUL739 | 5.10 |
| FUL900 | 1.20 |
| FUL914 | 1.20 |
| LM370 | 6.75 |
| LM372 | 5.62 |
| MC1303 | 5.20 |
| PA246 | 13.60 |
| TAA300 | 4.32 |

### *SPECIALS*

| | |
|---|---|
| AY1101 | .35 ea. |
| AY1103 | .55 |
| AY1104 | .74 |
| AY1110 | 1.07 |
| AY1112 | .61 |
| AY1115 | .49 |
| AY1116 | .49 |
| AY1117 | .49 |
| AY1120 | .67 |
| AY1121 | .67 |
| AY8110 | 2.59 |
| AY8111 | 2.59 |
| SE1001 | .35 |
| SE1002 | .56 |
| SE1010 | .61 |
| SE4001 | .48 |
| SE4002 | .55 |
| SE4010 | .62 |
| SE7001 | 2.80 |
| 2N3053 | 1.57 |
| 2N3054 | 1.80 |
| 2N3055 | 1.30 |
| 2N3568 | .67 |
| 2N3569 | .71 |
| 2N3638 | .60 |
| 2N3638A | .75 |
| 2N3640 | .97 |
| 2N3641 | .61 |
| 2N3642 | .81 |
| 2N3643 | .75 |
| 2N3644 | .81 |
| 2N3645 | 1.00 |
| 2N3646 | .73 |
| 2N3693 | .35 |
| EM404 | .26 |

**HEADPHONE PROBLEM:** I am building one of the transistorised crystal sets described in the July, 1969 issue. I tried to buy headphones with 2000-4000 ohm impedance which you recommended but was told that headphones of this type are no longer made. Instead I was offered a crystal type earphone which I was told was "half a meg" impedance. Will this do for the circuit? If not, what other hearing devices can be used? (F.B., Guildford, NSW.)

The matter of crystal earpieces as a substitute for headphones, when the high impedance type cannot be obtained, is fully covered in the article, on page 81, top of column three. We do not feel there is anything we can usefully add to the information already given.

**TELEPHONE AMPLIFIER:** Could you describe a telephone amplifier, a more up-to-date version than the one featured in the early 1950s? The type I mean is one that holds the handset and enables the user to be a few feet away from the set, yet be able to hear and talk normally. (R.R., Magill, SA.)

Presumably the unit you know about is the one that was described in the February, 1954 issue. A transistorised version was published in the April, 1958 issue, and we can supply project reprint material through the Information Service for the normal 50c fee. However, although this unit worked well with the handsets then commonly used, more modern handsets have more efficient magnetic circuits, and there may not be enough signal induced into the telephone amplifier to allow it to provide a sufficiently high level of output. While it might be possible to raise the output level with a more powerful amplifier, there is the possibility that hum troubles would make this course of action impracticable.

**STEREO MONO HEADPHONES.** I am unable to afford stereo equipment, and must listen to records monophonically on a pair of headphones. It appears that stereo headphones are the only ones available these days. Being a young reader, I would like to know how stereo units can be adapted to mono. Thank you for an excellent magazine. (J.C., Bilgola, NSW.)

Stereo headphones can be adapted to mono operation quite simply by connecting the leads from each earpiece together in either series or parallel configuration. This may be done where the phone leads connect to the jack plug or, if it is desirable not to tamper with the phones, the connections may be arranged at the socket. This will leave the phone connections intact for use in the conventional stereo mode if and when the opportunity occurs.

**RESISTOR CODING AND MATCHING IMPEDANCES:** Can you suggest two books which explain how to calculate resistor values from their colour bands, and one which will give information relative to matching impedances between various sources and loads in amplifying equipment? (P.K., Murray Bridge, SA).

On the subject of matching impedances in amplifying equipment, P.K., there is no "standard" textbook which will wrap up the whole subject from "go" to "whoa". In most cases, an exact match is the condition most avoided — strange as this may seem! In this condition, there is equal power dissipation in both generator and load impedance, producing an efficiency of only 50%. Resistor colour coding information was published in our magazine in the November, 1969 issue under file number 8/LT/11. Reprints of these are available from this office for 50c each.

**DELTAHET:** I am interested in constructing the transistor Deltahet receiver. In which issues of your magazine was this described? Are these issues available or can you supply project reprints. Also, has any additional information been published since the original articles? (E.V., Carlton, Vic.)

The Deltahet Mk 2 was published as a series of five articles from January to May, 1971 inclusive. There has been no further information published. Our stocks of the January and February, 1971 issues are exhausted. We can supply copies of the March, April and May, 1971 issues through the Information Service. (See p120 for surcharge). Alternatively, reprints of all the articles (Files Nos 2/SW/56 to 60 inc) are available for 50c each.

**MODIFIED REFLEX PORTABLE:** I successfully built the Reflex Portable described in the February, 1972 issue, but used a loudspeaker in place of the headphones. The sound was very soft, so I decided to make the amplifier featured in your Septemer, 1971 issue, page 96. I connected it up, but it did not work, although it worked well with a crystal set. Can you tell me why, and how I can make it work? (G.P., Annandale, NSW.)

Since you have not told us how you have interconnected the two it is impossible for us to comment. Fairly obviously something was amiss. We suggest you supply a sketch showing how the units were connected.

**IGNITION SYSTEMS:** Are back numbers for August, September and October, 1970 available? If so, what is the cost? If they are not available, can you supply reprints of the articles describing a capacitor discharge ignition system and the all-electronic ignition system? (L.B., Pinnacle, Qld.)

Unfortunately our stocks of the issues you require are exhausted. However, copies of the articles (File No 3/TI/6 and files Nos 3 TI/7 & 8 respectively) are available through the Information Service for 50c each. Incidentally these articles were followed in November, 1970 by an article entitled "Further Thoughts on CDI". Copies of this article (File No 3/TI/9) are also available for 50c.

**TRIACS:** When I bought some AC06DT triacs, the connections for the device as supplied by the dealer were different from those printed in your February issue. A1 and A2 are interchanged. Does this matter? What are the ratings of the EM4005 diodes? Would EM402 diodes be suitable replacements. Congratulations on the changes made to the magazine over the last few months. They improved an already fine publication. (G.S., Blair Athol, SA.).

To the best of our knowledge the information given by the dealer is incorrect. This is because our information comes directly from the manufacturer, ITT, and also, almost all devices of this type have their A2 as the case. It certainly does matter if the connections are mixed. We suggest you follow our diagram, or, alternatively, ask your dealer himself to check with ITT. The current rating of all EM400 series diodes is 1 amp. The voltage rating may be worked out from the numbers following the figure four. Merely insert a decimal point between the four and the next figure, and move it four places to the right. This then is the PIV. Therefore, an EM4005 is a fifty volt diode, and the EM402 is a 200 volt diode, and can be substituted. Thanks for the compliments.

**LICENCE:** I have already built a shortwave receiver, and am now thinking of building a transmitter. I was wondering what the age limit for the amateur licence is, and how I would go about getting one. (P.R., Mornington, Vic.)

You must be at least 15 years old before you are allowed to sit for the amateur operator's examination but a licence will not be issued (if you pass) until you turn 16. Further information may be obtained from the Radio Branch, PMG's Department in your capital city, or from the State offices of the Wireless Institute of Australia.

**RADIO CONSTRUCTION:** I want to build a wireless. What components do I need, and how much will it cost me? (W.Z., Lidcombe, NSW.)

We can supply a circuit, instructions and parts list for a variety of radio sets, but we need to know what type you wish to build. Do you want it for broadcast or short-wave listening, battery or mains powered, valves or transistors? It is not our policy to quote prices. Inquiries for these should be addressed to component and kit suppliers, who advertise regularly in our magazine. Incidently, we wrote directly to you but our letter was returned "Not known at this address".

**INTERCOM:** I am half way through building the Intercom Unit as described in August, 1971. I would like to know if it is possible to add an extra slave station into the original circuit. If so, could you please advise me of the necessary connections. (S.H., Mount Waverley, Vic.)

The purpose of the original exercise in describing the Silicon Transistor Intercom was to present the simplest possible unit for beginners and to give them, not only some experience in audio amplifier construction, but to arrange that they would have a useful piece of equipment when finished. Unfortunately we

**(Continued on page 127)**

### SOUND PROJECTORS
Cinevox Prefect and Harmour and Heath 16mm in good working order. 240v operated, complete with speaker and amplifier.
**from $115.00**

### CIRCULAR SLIDE RULE
3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.
**from $1.25 each**
Post 12c.

### P.M.G. TYPE TELEPHONES
Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.
**$25.00**
(2 TELEPHONE SETS)
30c. cartage to rail. Freight payable at nearest attended railway station. Please note we are now able to include ¼ mile of twin telephone cable FREE with each set of phones.

### BATTERY CHARGERS
240 volt AC Input
Each battery Charger will charge either 6 or 12 volt batteries.
2 amp without meter **$15.75**
2 amp with meter **$17.75**
Post N.S.W. 95c.; Interstate $1.20.

### MINIATURE ELECTRIC MOTORS
1½ to 3 volts DC. Ideal for model boats, cars, planes, etc. Strong torque. Only
**65c. each or 10 for $4**
(Post 12c.)

### TRANSCEIVER
(2-way radio) R.C.A. America RT 68, 24 volt, operated 10 watt output 38-54MHz F.M. crystal locked. Transmitter and receiver using frequency synthesiser in 100KHz; step 10 channel per MHz with power supply, mike, and headphones. **$45.** 60c. cartage to rail. Freight payable at nearest attended railway station.

### TRANSCEIVER
(2-way radio) 62 set, 12V, operation. Ideal Hams, etc. 1.6 to 10MHz. Crystal locked or VFO controlled. 5 watt output. Complete with antenna, headphones and mike. **$60.** 30c. cartage to rail. Freight payable at nearest attended railway station.

### HEADPHONES
Low impedance moving coil fitted with rubber muffler to reduce external noise, fitted with press to talk, dynamic hand microphones. Ideal for use with all types of transceivers. **$3.50** pair.
Post N.S.W. 45c.; Interstate 65c.

### COLLINS TRANSCEIVERS
Auto-tuned 100-150MHz. 10 channels.
**$65.00**

### HALF-INCH RECORDING TAPE
Top grade 2400' on 10½" reels. Ideal video experimenting. Only **$1.50** per reel.
Post N.S.W. 45c.; Interstate 75c.

### LAVOIE HETERODYNE FREQUENCY METERS
10-100MHz. LA5 **$250.**
100-500MHz. **$350.**

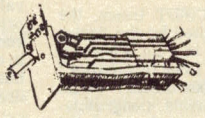
### ADLER FREQUENCY METER
100KHz-20MHz. **$175.**

### 4 DIGIT RELAY COUNTERS
50-volt DC, suit slot car. Lap counters, etc.
**$1.25** each. Post 18c.

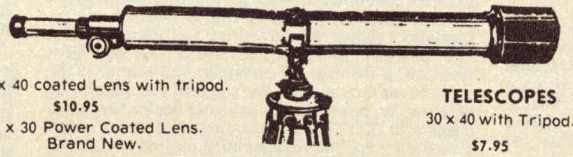
### NIBBLING TOOL
Cuts sheet metal like a punch and die, trims, notches and cuts to any size or shape over 7 16-inch.
**ONLY $6.50**
Post 74c.

### NIFE CELLS
1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.
**$1 each.**
Post N.S.W. 25c. Interstate 35c.
3.6V 10AH, set of three batteries in wooden holder, **$7.50** per set or **$2.50** per battery 1.2 volt 10AH.
Post N.S.W. $1.10; Interstate $2.72.

### COMMAND RECEIVERS
Q5 190-550 K/ CS. **$22.50**
3 TO 6 M/ CS. **$15.00**
6 TO 9 M/ CS. **$15.00**
POST: N.S.W. $1.25, INT. $1.44



P.M.G. TYPE KEY SWITCHES.
**45c** each. Post 24c.



45 x 40 coated Lens with tripod.
**$10.95**
30 x 30 Power Coated Lens. Brand New.
**$3.75.**
50 magnification with a 60mm coated objective lens. With tripod.
**$27.95**
As illustrated.
Postage $1.20; Interstate $1.45.

### TELESCOPES
30 x 40 with Tripod.
**$7.95**
Post N.S.W. 95c; Interstate $1.45

### BC221
Frequency Meters.
**$55.00**

### SMALL COMPUTER PANELS
3in x 2in containing 2 valves, qty. of resistors, etc.
**ONLY 75c.**
Post 24c.

### COMMAND TRANSMITTERS
5-3-7 M/ CS. **$10.00**
Post: N.S.W. **$1.25** Int. **$1.44**

### TYPE S POWER SUPPLY
(240 V AC supply for AT 5-ARB). Suit most types of Disposal transmitters and receivers. Outputs 250 volt, 10mA, 550 volt 200mA, 300 volt 100mA. **$30.**

BC348 RECEIVER **$80.00**

### A.W.A. B.F.O. TYPE R7077
1-800 CYCLES
1-13 K/ CS. **$30.00**

### CO-AXIAL SWITCH
70 ohms, 4 positions.
Can be motor driven, completely waterproof, 70 ohms type connectors. Housed in metal case 9in x 8in x 8in, **$5** each.
Post N.S.W. 95c.; Interstate $1.45

### ELECTRONIC COUNTER
(Austronic) 0-100KHz. 240V operated.
**$150**

Cossor Double Beam Oscilloscope 1035. Tested.
**$150**

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## BRAND NEW
### IN CARTONS
Special discount for quality

| | | | |
|---|---|---|---|
| 807 | 75c | CV850 | $1.50 |
| 65N7GT | 95c | 1H6G | 30c |
| 8989 | $1.00 | 832 | $5.00 |
| 5U4G | 95c | 6AK5 | $1.50 |
| EF50 | 35c | 6X4 | $1.00 |
| 5Y3 | $1.75 | 12SK7 | 50c |
| 6C4 | 50c | VR65 | 25c |
| 2 x 2 | 75c | VT4C | 75c |
| 6AG5 | 80c | 80 | $1.25 |
| 12AU7 | $1.00 | | |

**Please add postage on all articles**

### RADAR TRANSCEIVER
X BAND WITH KLYSTRON ETC. **$45.00**

### TRANSMITTERS ARC 49
100-165 M/ CS **$25.00**

### CHASSIS PUNCH SET
Five sizes: ⅝-inch, ¾-inch, ⅞-inch, 1-inch and 1⅛-inches. With taper reamer.
**$9.00**
Post, $1.15

SELSYN MOTORS MAGSLIP Mk. II ..... **$5.25 ea.**
No. 19 TWO-WAY RADIOS. Power supply, accessories, etc., **$35.**

### BINOCULARS
PRISMATIC. Coated Lenses. Brand new. Complete with case.

| | |
|---|---|
| 6 x 30 | $12.50 |
| 8 x 30 | $19.95 |
| 7 x 50 | $24.50 |
| 10 x 50 | $25.50 |
| 12 x 50 | $26.50 |
| 20 x 50 | $29.50 |

Post N.S.W 95c; Interstate $1.45.

### 3000 TYPE RELAYS
P.M.G. 200 Ohms — 1,500 Ohm Coils. **$1.25** each. Post 24c.

### TOGGLE SWITCHES
Brand new, 3 amp, 240 volt. S.P., S.T. **39c** each or 10 for **$3.**
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Cintel Oscillator and Electronic Counter, type 388. **$250.**

SPECIAL lucky dip valve offer, 15 new valves in cartons for only **$2.** We haven't got time to sort them, so you reap the benefit.
Post 75c.

### CONDENSER LENS
1½in diam. 1½FL. **50c** each.
Postage 24c.

### MINE DETECTORS
Ex A.M.F. with Instruction Book. Complete in wooden case. Ideal for plumbers, councils for locating buried pipes, etc. Freight payable at nearest attended railway station. **$39.00**

### ALTEC STUDIO MICROPHONES
639B Western Electric, top grade. Original cost **$250,** Ideal Broadcast Studio, music recording. Church and play recording, etc.
Fraction of original cost.
Price on application.

### SPECIAL PURCHASE TOP GRADE RECORDING TAPES
Brand new, from well-known maker. Sorry, we cannot divulge brand name. 7" x 2,400' Mylar in plain carton.
Only **$3.50** ea. Post 35c.

### SOLENOIDS
Plunger Type 12V 300MA. Suit electric camera control, miniature trains, radio. etc.
**$1.25.** Post 24c.
200 MA 24 volt, ⅛in push movement.
**$1.25.** Post 24c.

### CONDENSER LENS
2½in DIAM. 2in FL. **$1.50** each. Or **$2.50** per pair. Post 24c.

### TELETYPE TELEPRINTER TAPE REPERFERATOR
With Keyboard **$35.00**

### FIELD STRENGTH METERS
144 M/ CS. **$12.50**

### TEN CHANNELS VHF TRANSCEIVER
Types TR 1934 100-125 MHz and TR 1935 125-150 MHz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator. **$33.00**

### RECORDING TAPES
TOP QUALITY, BRAND NEW

| | | Post |
|---|---|---|
| 3" x 150' | 65c | 12c |
| 3¼" x 600' | 1.58 | 13c |
| 5" x 900' | 1.95 | 13c |
| 5" x 1800' | 3.62 | 13c |
| 7" x 1200' | 3.18 | 24c |
| 7" x 2400' | 4.80 | 74c |
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### CASSETTE TAPES
C60 **$1.15;** C90 **$1.75;** C120, **$2.25**
Post 13c.

Crystal Earphone ..... **75c**
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### DUMPY LEVELS
Made by Watts, excellent condition with tripod. **$77.50**

### BYER 77 Mk. 1
Rack Mounting Tape Recorder ex A.B.C. 7½-15 ips. Full track tested **$150.**

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### A.W.A. SIG GENERATOR
UHF 140-300 MHz **$65.00**

Pye 4 Channel Crystal Locked Oscillator, 1.5-30 MHz New. **$25**

### TRANSPONDER APX6
with Lighthouse Tubes. Can be converted to 1200 MHz. **$17.**

### RECEIVERS ARC 49
100-165 M/ CS **$25.00**

# Deitch Bros.
## 70 OXFORD STREET, SYDNEY 2010
SORRY, NO C.O.D.

## SERVICEMAN . . . from p. 67.

further to the layman's confusion and misconception.

As for the columnist's comments, there appear to be two statements which are doubtful. The first is: "A decibel is the lowest sound detectable by the human ear in quiet surroundings."

Taken at its face value, and on the basis that 0dB is the threshold of hearing, it implies that 1dB above the threshold of hearing is the lowest sound which can be heard — a somewhat contradictory statement.

It is more likely that it is a garbled version of a statement to the effect that a change of 1dB is the smallest change detectable by the human ear in quiet surroundings; which would be about right assuming a steady tone and a conscious effort to detect a change.

The second doubtful statement, ". . . . an increase of 3dB would mean double the intensity of sound", is more serious. I imagine most people would read this to mean that such an increase would produce a subjective effect of "twice as loud".

In fact, this is exactly what it would not do. As has been already stated, doubling the sound energy (not intensity) represents an increase of 3dB, but that the subjective effect of this is more likely to be "just noticeable".

For this reason, an improvement of only 3dB in any system, whether it be a 3dB increase in the output of an amplifier, or a 3dB reduction in the engine noise of a jet, is not regarded as particularly significant, unless it can be achieved without incurring serious disadvantages, including economic ones.

To provide a subjective effect of "twice as loud" or "half as loud" a change of 10dB would be required.

Considering the importance which people in a noisy area are going to attach to dB figures which are quoted from time to time, it is essential that they be able to interpret them in a meaningful way. To create the impression that a 3dB change represents a subjective reaction of two to one is quite wrong, and therefore dangerously misleading.

## RELIABILITY . . . from p.37

tractive — is to allow easy access to each module and its associated test points. As stated previously, the preferred type of case is that which folds back so that every essential part of the circuit is available for testing and servicing.

**MAINTENANCE PROBLEMS**

If maintenance engineers are not to spend most of their working time studying complex circuits and equipment in attempts to localise and rectify faults, test and fault-finding procedures must be standardised by manufacturers. Maintenance and servicing requirements, especially in respect of large installations, are now such that the responsible engineer must include in his tool-kit such items as an oscilloscope and possibly a valve voltmeter. He must also familiarise himself with the waveforms at each test point, in order to recognise a complete or partial malfunction, and know when to replace a unit.

(Continued on page 127)

# MARKETPLACE

DISPLAY ADVERTS in MARKETPLACE are sold in multiples of one inch to a maximum of five inches. Rate $10.00 per inch per insertion, subject to continuity discounts.

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ADDRESS all classified orders, copy, enquiries, etc. to: The Advertising Manager, ELECTRONICS Australia, Box 2728 G.P.O., Sydney 2001.

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**WE SELL** construction plans. TELEVISION: 3 D converter, $25 camera, Kinescoping recorder, VTR, colour convertor. HOBBYIST: Electron microscope, 96-hour music system, voice typewriter, Morse code to typewriter copier, transistorised teletype. TELEPHONE: Answering machine, pushbutton dialer, phonevision, auto-dialer, telephone extension in your automobile, legal connector. SECURITY: Microphone jammer, voice scrambler, microdot photography. Plans $5.00, air shipped from our USA research labs. COURSES: Telephone engineering $39.50, security electronics $27.50. investigative electronics $22.50. Super hobby catalogue air mailed $1.00. Payment accepted in dollars (Australian, New Zealand or US). Don Britton Enterprises, Suite 28, 280 Pitt Street, Sydney, Australia.

**CRYSTALS** for CB, 27.240 and 26.785MHz, ¼in pin, miniature, $6 pair, post free. Shalley, 127 York Street, Sydney.

**BACK** issues Electronics Australia stocked, 50c each, prompt service, post free. T. Weir, 56 O'Connor Street, Haberfield, NSW 2045. Phone 798 7569. Wanted to buy copies also.

**LINEAR** amps, as supplied Govt depts, various bandwidths within 5KHz to 250MHz. SSB module systems 2 to 30MHz, 12 to 28V from $2 per W. Also supplied with quasi high level modulators for MCW. SAE. E. Newman, 27 Berry Street, Regents Park, 2143.

**DIGITAL** counter display modules from $8.00. Sae for details 16 Coles Place, Torrens, ACT.

**SEMICONDUCTORS** — AC 125-126-128-75c ea. BC 107-69c ea. BC 108-52c ea. BC 109-60c ea. BC 186-67c ea. CV7003, 7004 (OC44 and OC45)-55c ea. OC71, 72-50c ea. AF116N, 117N-71c ea. 2N3646-52c ea. UJT 2N2646-$1.20. SCR BT100A 500R -$2.50 ea. BTY79 500R-$4.50. BA 100-36c ea. OA90, 91-25c ea. EM404-48c ea. SD408 (BY100 800PIV)-65c ea. Resistors, hi-stability, ½W 1000ohms-10m-6c ea. Post and pack 20c RTC Components, PO Box 46, Sale, Vic 3850.

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**DECCATRON** 4 radiation counter complete with Geiger Muller probe as is $50. Call Sydney 57 8511.

**TRANSCEIVER** Heath HW32 tribander with AC & DC supplies $150. Receiver Star SR600. 1kHz readout, var IF, notch filter, amateur bands 3.5 to 30Mhz, $125. Adelaide 95 5225 nights except Monday & Wednesday.

**MODEL** mill engine no 2, castings, plan, $14.45 posted. Bolton, 72 King Street, Sydney. Catalogue $1.80.

**AMATEUR** transceiver Lafayette HB525 for 10m use. Solid state, excellent cond. Phone Sydney 371 5052 AH.

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**REPAIRS** to receivers, transmitters, construction testing, TV alignment, xtal conv, specialised electronic equip. Eccleston Electronics, 146a Cotham Road, Kew, Vic. Phone, Melbourne 80 3777.

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**AUSTRALIAN** Tape Recording Society offers tape library, "The Microphone" journal, audio visuals, round robins, tapespondence, sales. Inquiries, PO Box 130, Hornsby, NSW 2077. Please enclose large, stamped envelope.

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**WHARFEDALE** speakers. One Super 8CS AI, alternatively two Super 8/RS DD or two super 8/FS. Also two W12/RS/PST or two W15/RS. Write G. D. McGeorge, 72 Victoria Street, Temora, 2666. Telephone 789.

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**SWEEP MARKER** generators. Price and particulars to W. Sorensen, 42 Cortess Street, Toowoomba, 4350 — Telephone 35 3796.

**ONE OLD** Eddystone Wide World Four TRF receiver 1935-7 model complete with valves and coils. Quote price wanted to Luff, Mt Tamborine Qld 4271.

## POSITION VACANT

**ELECTRONIC** service technician for work in service division of progressive company distributing and renting professional motion picture equipment including recorders, cine cameras, crystal motors, etc. Birns and Sawyer Pty Ltd, 19-21 Cleg Street, St Leonards, NSW 2065. Phone Sydney 439 3104.

## ANSWERS ... from p.123

are not in a position to advise on possible expansion of the project.

**PLAYMASTER 131 TUNER:** I would like to team up the Playmaster 131 Tuner with an AWA Tri-Fi Modular Stereo system. Would the reception be satisfactory with the combination? I have been reading your magazine for only a year now, and have been very interested in the above tuner, but missed the February, 1971 issue containing the article describing it. I have been very pleased with the contents of your magazine with all of its interesting projects and features. (F.S., Moe, Vic.)

Thank you for your remarks about the magazine, F.S. If your require a reprint of the Playmaster 131 IC Tuner article, these are available from this office for 50c each under file number 2 TU 32. Since, as a matter of policy, we do not file specifications (or make recommendations) in respect to commercial systems, we do not know if sufficient gain is available to amplify the audio sufficiently. The audio output voltage of the tuner is low, about 50mV for a typical broadcast signal, and a small booster amplifer stage may possibly be required to raise the level. You will have to check the specifications of your amplifier to ascertain if it is sensitive enough for the purpose.

**LISTENERS'GUIDE:** In your annual television stations list, you said that information about overseas TV stations could be obtained from the "World Radio & TV Handbook". My local newsagent is unable to obtain this book. Can you tell me how to obtain it, and what is its price? (J.P., Oak Flats, NSW.)

A review of the 1972 edition of this book appears in this issue on page 108. Copies should be available from most larger booksellers, but may also be obtained in Australia from the Technical Book & Magazine Co, 289-299 Swanston Street, Melbourne, 3000. The price is $5.95 plus postage (50c in Victoria, 65c interstate). In New Zealand, inquiries should be addressed to our short wave contributor, Mr Arthur Cushen, 212 Earn Street, Invercargill.



## RECEIVER ... from p. 35

and then adjust the trimmer on the aerial section of the gang for maximum response. As is always the case with the alignment process, the procedures for 3.5 and 7.5MHz should be repeated until alignment is complete.

If a generator is not available, then a good idea is to do the job of alignment at night when the standard time-frequency station VNG is on the two frequencies of 4.5 and 7.5MHz. An aerial should be connected and the procedure followed much the same as that just described, except that 4.5MHz is used instead of 3.5MHz.



## RELIABILITY ... from p.125

Power electronics also presents problems. It is not now a matter of replacing a standard-type fuse, for fuses are now matched in characteristics with thyristors and rectifiers and only the correct fuse can protect them. Here again, the engineer must recognise whether it is a thyristor or its gate signals which are at fault.

Manufacturers usually give good after-sales service, but the maintenance engineer should only call them in for help in solving basic problems — not for faults that come under the heading of general maintenance and servicing. In the case of large equipment, there is a period following installation and commissioning during which the manufacturer should resolve the basic problems and it is during this period that the maintenance engineer can familiarise himself with the equipment and at the same time determine what test equipment is required.

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# Index to Advertisers

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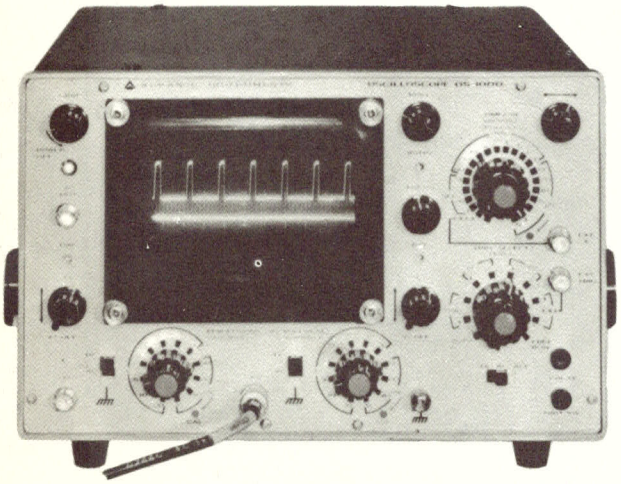


## OS1000 oscilloscope

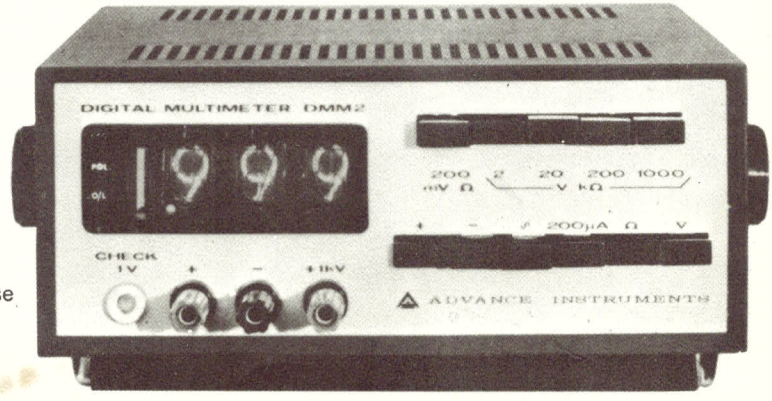
**OUTSTANDING FEATURES** • DC to 15 MHz bandwidth • 5mV/cm dual trace • Signal delay • Comprehensive trigger facilities, incl. TV sync. • Bright line auto free-run • Switched X-Y operation

The ADVANCE OS1000 is a portable, dual trace oscilloscope, combining small size and light weight with a specification providing the ability to make precise waveform measurements. Wide time base ranges and comprehensive trigger control combined with broad bandwidth and calibrated deflection factor make this instrument suitable for many general purpose and laboratory and TV applications. Use of solid state circuitry throughout makes the OS1000 particularly suitable for servicing or laboratory use.
Full specifications available on request.

## DMM2 digital m/meter

**OUTSTANDING FEATURES** • 17 ranges for measurement of AC or DC voltage, current and resistance • Maximum stability • LSI reliability

The DMM2 Digital Multimeter provides in 17 ranges a clear digital reading of AC or DC voltage, AC and DC current and resistance. Push button selection of functions and ranges. The display has a max. reading of 1999 with automatically positioned decimal point. Overrange and reverse polarity indications are provided. The DMM2 weighs only 3½ lb and can be operated from AC supply, external 12V DC, or an optional rechargeable battery pack. Design ensures maximum stability for all measurements, ease of operation allowing use by non-technical operators and high reliability with all counting and storage functions performed by an LSI package (Large Scale Integrated Circuit). Full specifications available on request.

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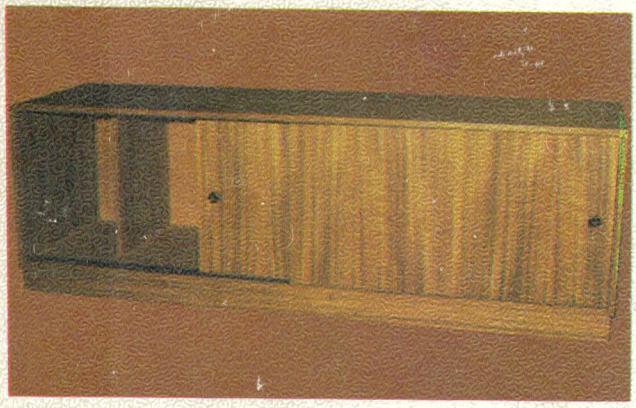
**MODEL RS No. 2**
A larger unit measuring 35½" x 14" (high) x 15¾" (deep), the kit is priced at $41.00 (maple veneer) or $43.00 (teak veneer).



**MODEL RS No. 3**
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**MODEL RS No. 4**
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